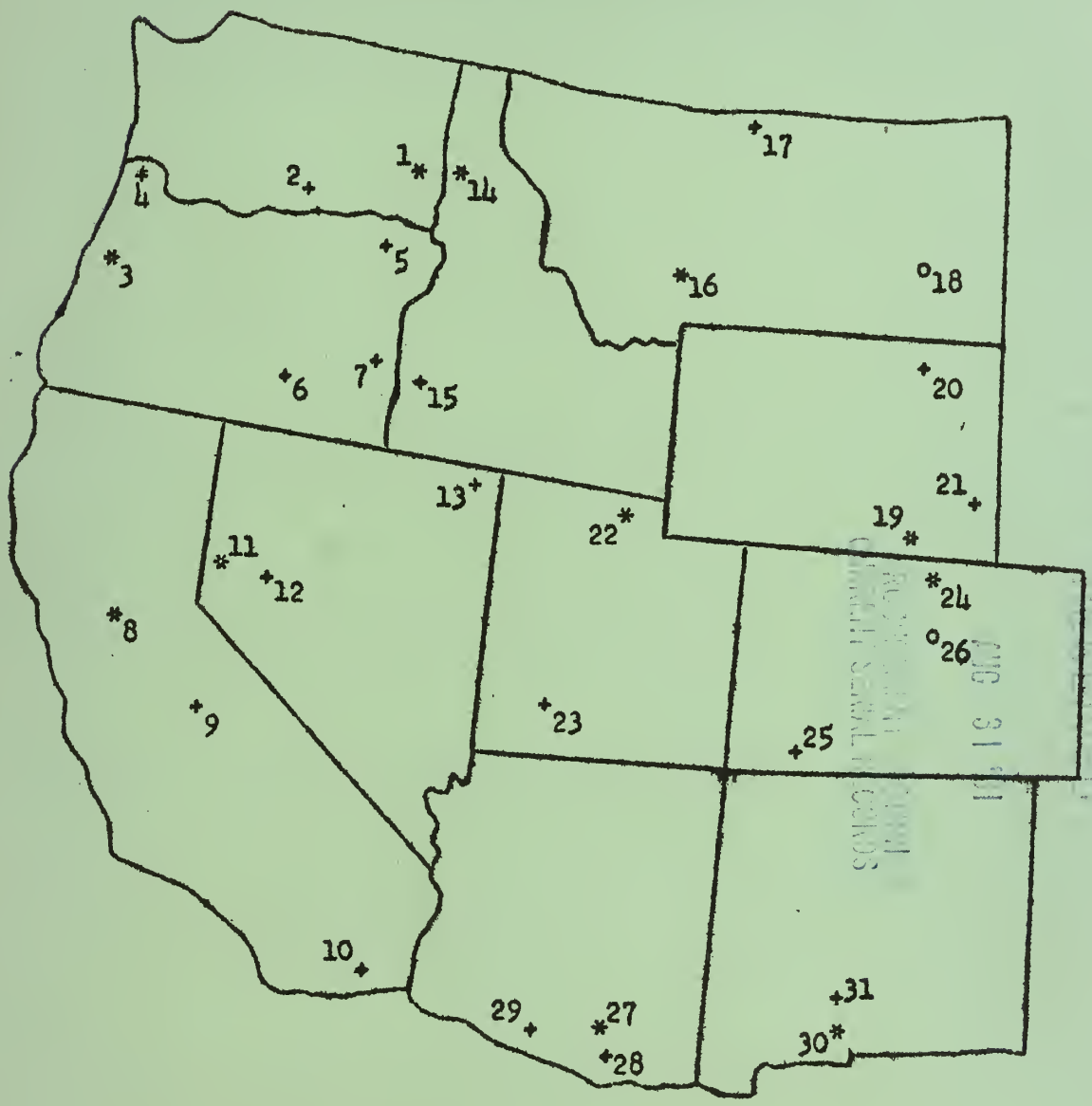
U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ANIMAL INDUSTRY
AND
COOPERATING WESTERN STATES






1952 Annual Report of
W-1
THE IMPROVEMENT OF BEEF CATTLE THROUGH
THE APPLICATION OF BREEDING METHODS

July 1, 1952

This report is intended for use of administrative leaders and workers and is not for general publication.

# C O V E R

Major Experimental Centers for Beef Cattle Breeding Research in the Western Region.

Washington

1. Washington State College, Pullman.
2. Prosser Experiment Station, Prosser.

Oregon

3. Oregon State College, Corvallis.
4. John Jacob Astor Branch Experiment Station and Northrup Creek Experimental Area, Astoria.
5. Eastern Oregon Branch Livestock Station, Union.
6. Squaw-Butte-Harney Station, Burns.
7. Malheur Experimental Area, Ontario.

California

8. University of California Experiment Station, Davis.
9. San Joaquin Experimental Range, O'Neals.
10. Imperial Valley Station, El Centro.

Nevada

11. University of Nevada Experiment Station, Reno.
12. Fallon Experiment Station, Fallon.
13. Knoll Creek Field Station, Contact.

Idaho

14. University of Idaho Experiment Station, Moscow.
15. Caldwell Branch Station, Caldwell.

Montana

16. Montana State College, Bozeman.
17. Havre Experiment Station, Havre.
18. U. S. Range Livestock Experiment Station, Miles City.

Wyoming

19. University of Wyoming Experiment Station, Laramie.
20. Gillette Substation, Gillette.
21. Torrington Substation, Torrington.

Utah

22. Utah State College, Logan.
23. Cedar City Station, Cedar City.

Colorado

24. Colorado A. & M., Ft. Collins.
25. Ft. Lewis Experiment Station, Ft. Lewis.
26. National and Western Regional Coordinator's Office, Denver.

Arizona

27. University of Arizona Experiment Station, Tucson.
28. Empire Ranch, Sonoita.
29. Boice Ranch, Arivaca.

New Mexico

30. New Mexico A. & M., State College.
31. New Mexico A. & M. Experimental Range.

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History of W-1

The importance of cooperative action in beef cattle improvement investigations has been recognized by research workers in this field for many years. Prior to 1945 the Montana Experiment Station and the Bureau of Animal Industry, U. S. Department of Agriculture, had been engaged in cooperative research at the U. S. Range Livestock Experiment Station, Miles City, Montana. On March 5, 1946, ten States in or adjacent to the Northern Great Plains area entered into an agreement with the U. S. Department of Agriculture for cooperative beef cattle improvement research. The States entering into this agreement were Colorado, Idaho, Montana, Nebraska, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming.

On August 14, 1946, President Truman signed Public Law 733, known as the Research and Marketing Act. This law provided a means of organizing cooperative research on a larger scale. By authority of this Act the W-1 project (A. H. 1.45) was approved on July 7, 1947, with 15 States cooperating. These States were Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming. The objectives of this project were:

1. The development of inbred lines of beef cattle that will be useful in the improvement of such characters as rate of gain, economy of gain, carcass quality, fertility and longevity.

2. To develop effective breeding techniques for improving the productiveness of beef cattle.

3. To investigate the productiveness of existing lines of beef cattle.

This memorandum included a 9b3 budget provision of $2,300 for travel expenses of authorized State representatives to attend a committee meeting. Director McKee of Montana was named Administrative Advisor and Dr. R. T. Clark served as Coordinator.

The original Memorandum of Understanding, A. H. 1.45, was superseded on January 20, 1948, by a new agreement which included the present 11 western States: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming, and the Territory of Hawaii. The States of Kansas, Nebraska, North Dakota and South Dakota became cooperating States in NC-1.

The first W-1 Technical Committee meeting was held in Salt Lake City, Utah, on October 15 and 16, 1948. Dr. Madsen of Utah was elected Chairman. Subsequent Technical Committee meetings have been held in Miles City, Montana; Fort Lewis, Colorado, and State College, New Mexico.

Dr. Carl Sierk was appointed Regional Coordinator for W-1 on May 1, 1950, with headquarters at the Beef Cattle Office, U. S. Department of Agriculture, Denver, Colorado, and served in this position until November 1, 1951, when he resigned to become Head of the Animal Husbandry Department at the University of Idaho. Dr. Carl Roubicek, of the University of Wyoming, assumed the duties of Regional Coordinator on January 20, 1952, at Denver, Colorado.

Technical Personnel
W-1 Project

Arizona: O. F. Pahnish*, E. B. Stanley and C. E. Safley.

California: P. W. Gregory*, Wade Rollins, N. R. Ittner, K. A. Wagnon, F. D. Carroll, H. R. Guilbert, G. P. Lofgreen, Kathleen Green, W. S. Ware, A. J. Thayer and Norman Freed.

Colorado: H. H. Stonaker*, S. S. Wheeler, J. E. Ingalls, M. H. Hazaleus, T. R. Blackburn and F. X. Gassner.

Hawaii: Oliver Wayman* and L. A. Henke.

Idaho: C. F. Sierk*, T. B. Keith, R. F. Johnson, C. W. Hickman, W. P. Lehrer, Jr., and C. W. Hodgson.

Montana: Fred S. Willson*, A. E. Flower, Joseph J. Urick and F. A. Ralston.

Nevada: James F. Kidwell*, Lyle McCartney, Cornelius Lingenfelter, Henry Johnson and A. J. Reed.

New Mexico: Ralph Durham* and John Knox.

Oregon:

Central Station: Ralph Bogart*, A. C. Warnuck, Hugo Krueger, A. W. Oliver, Fred F. McKenzie, J. J. Dahmen, Martin Burris and George Nelms.

Squaw-Butte-Harney Station: W. A. Sawyer and Farris Hubbert.

Eastern Oregon Station: H. G. Avery and Cecil Pierce.

John Jacob Astor Station and Northrup Creek Station: H. B. Howell and Elmer Dent.

Malheur Station: E. N. Hoffman.

Utah: James A. Bennett* and Darrell Matthews.

Washington: M. E. Ensminger*, M. W. Galgan, R. E. Christian and C. R. Kyd.

Wyoming:

Bureau of Animal Industry

R. T. Clark, National Coordinator, Denver, Colorado
C. B. Roubicek, Regional Coordinator W-1, Denver, Colorado

Miles City Range Experiment Station: J. R. Quesenberry and R. R. Woodward.

Regional Administrative Adviser: Clyde McKee, Montana

* Technical Committee member.

University of Arizona

I. Technical Personnel: O. F. Pahnish*, E. B. Stanley and C. E. Safley.

II. Title of Project: Progeny Testing of Hereford Sires.

III. Object: The purpose of this study is to establish methods of evaluating the productivity of different Hereford sires as reflected by the conformation, growth capacity and efficiency of feed utilization of their progeny. Cow productivity is also considered an essential part of this investigation.

IV. Work Progress: In 1947 a well-established ranching concern offered this station the use of a breeding unit comprised of 200 purebred (unregistered) Hereford cows. Therefore, a program centered around this herd was activated in 1948. The top 160 females were divided into four sire groups on the basis of breeding, and each group was headed by a purebred Hereford sire.

Weights and conformation scores are taken on all calves at weaning time and at 18 months of age. Replacement heifers are selected on the basis of the weaning data and the 18-month records. Weaning data plus the results of feed lot performance tests determine the selection of prospective sires.

This project was designed with an evaluation of selection methods as the primary objective. However, the feasibility of establishing inbred lines will be considered at a later date.

In 1951-52 the livestock were equally divided between the Empire Ranch at Sonoita and the Boice Ranch at Arivaca. The program has been extended to include both cooperating ranches.

V. Results: Feed efficiency tests conducted on prospective sires have shown variations from 960 pounds to 1224 pounds in feed requirement per 100 pounds of gain over a 180-day feeding period. Average daily gains varied from 2.05 pounds to 3.28 pounds per day.

Selection indexes are being used to determine the relative merit of individual animals. An evaluation of results obtained by using different

The data used in the study of heifer indexes consisted of weaning weights, weaning scores, 18-month weights, 18-month scores and gains from weaning to 18 months for 55 and 47 replacement heifers dropped in 1948 and 1949, respectively. The heifers were all purebred Herefords, range raised in four adjoining pastures until August first of their first year, and then run in a single pasture until 18 months of age. They were weaning at an average age of 260 days.

V. Results: (Continued)

The indexes used in this study were:

$$\text{Selection index A (for replacement heifers)} = \frac{\text{Dev. from av. weaning wt.}^{1}}{\text{Standard Dev. of weaning wt.}} + \frac{\text{Dev. from av. Conf. Score}^{2}\text{ (wean.)}}{\text{Standard dev. of conf. score (wean.)}} + \frac{\text{Dev. from av. 18 mo. wt.}^{3}}{\text{Standard dev. of 18 mo. wt.}} + \frac{\text{Dev. from av. Conf. Score}^{2}\text{ (18 mo.)}}{\text{Standard dev. of conf. score (18 mo.)}}$$

Selection index B (for replacement heifers) = The same basic index as index A with independent culling levels of .9 of one standard deviation below average of both weaning weight and 18-month weight being employed as well as the independent culling levels of 8.0 for both weaning and 18-month conformation score.

Selection index C (for replacement heifers) = The same basic index as A with independent culling levels of 2/3 of one standard deviation below average of both weaning weight and 18-month weight being employed as well as the independent culling levels of 8.0 for both weaning and 18-month conformation score.

[1]All weaning weights corrected for age of heifer and dam.

[2]Independent culling level used to extent that animals with score of less than 8.0 at weaning time or 18 months of age were culled.

[3]All 18-month weights corrected for age.

The following table shows the summation of relative selection differentials for weaning weight, weaning score, 18-month weight and 18-month score by years and by method of selection:

SUMMATION OF RELATIVE SELECTION DIFFERENTIALS[1] OF FOUR[2] CHARACTERISTICS

| | 1948 | 1949 |
|---|---|---|
| Selection by visual observation | 1.84 | 1.27 |
| Selection of the high 45%, by index A, from each sire group | 2.35 | 1.96 |
| Selection of the high 45%, by index A, from all available | 2.86 | 2.39 |

[1]Actual selection differential divided by the standard deviation of that characteristic.

[2]Characteristics used in calculation of the selection index.

V. Results: (Continued)

This shows that visual observation sacrificed much of the total advantage possible. The data indicate that this total advantage was primarily due to weaning and 18-month weights each year; thus, rather important gains in selection differentials for both weaning weight and 18-month weight could be made by following the index.

Comparing selection by index A to that by index B

Negative selection differentials for weight obtained in individual sire groups indicated a weakness in index A. Because of this weakness one standard deviation below average was used as an independent culling level for weight but was not severe enough to reject animals that were responsible for negative differentials both years. Then 0.9 of one standard deviation below average weight (at both weaning time and at 18 months of age) was employed as an independent culling level in index B along with that of 8.0 for conformation score. This method of selection eliminated all of the negative selection differentials for weight and conformation score when selecting the high 45% of all heifers available. Index B offered no consistent or material advantage over index A with regard to post-weaning gains. Using index B when selecting within sire groups did not permit the retention of 45% of the heifers by sire 5 in either 1948 or 1949. Thus, a comparison of these selection differentials with those obtained by index A would not be valid.

Comparing selection by index B to that by index C

Changing the independent culling level for weight from 0.9 to 2/3 of one standard deviation and keeping the culling level of 8.0 for conformation score did not produce material changes in the selection differentials for the five characteristics. It did limit selection to less than 45% of the heifers in 1948 and 1949 when selections were made on the sire group basis.

Selection on the basis of a single characteristic

The following tabulations provide relative indications of the over-all phenotypic improvement of the five characteristics involved when selections were based on but one.

RELATIVE EMPHASIS TOTALED FOR FIVE TRAITS
TWO YEARS' DATA

| When selecting for: | Wean Weight only | Wean Score only | 18 mo. weight only | 18 mo. conf. score only | Gain from wean to 18 mo. only |
|---|---|---|---|---|---|
| Summation of relative emphasis of the 5 traits if | | | | | |
| Selecting the high 45% from each sire group - | 2.98 | 2.51 | 3.79 | 2.90 | 2.31 |
| Selecting the high 45% from all available - | 4.57 | 3.78 | 4.78 | 3.93 | 1.26 |

V. Results: (Continued)

Whether selecting a certain percentage within sire groups or a similar percentage from all heifers available, 18-month weight shows the highest positive association with the other characteristics while gain in weight from weaning time to 18 months of age shows the smallest positive association.

Negative selection differentials for post-weaning gains were obtained when selections were based upon weaning weight or conformation score at weaning time. In addition, a tendency toward negative selection differentials for weaning weight and weaning score was apparent when gain from weaning to 18 months of age determined the selections made.

VI. Animal Inventory:

Hereford (unregistered)

| | |
|---|---|
| **Empire Ranch** | |
| Bulls, 1 year or over | 4 |
| Calves | 38 |
| Females, 2 years or over | 87 |
| Yearling | 29 |
| Calves | 37 |
| **Boice Ranch** | |
| Bulls, 1 year or over | 4 |
| Calves | 37 |
| Females, 2 years or over | 82 |
| Heifers | 29 |
| Calves | 34 |

VII. Facilities:

Empire and Boice Ranches

1. Pasture, buildings and equipment necessary to properly handle livestock.

University Station

1. Thirty individual feeding pens.
2. Corrals and scales.
3. Feed-lot equipment.

VIII. Manuscripts and Publications:

a. Progress Report, Arizona Agricultural Experiment Station. 1949-50.
b. Progress Report, Arizona Agricultural Experiment Station. 1950-51.
c. "Selection of Faster Gaining Beef Cattle by Performance Testing." Progressive Agriculture in Arizona, Vol. III:2. July 1951. Arizona College of Agriculture, Tucson, Arizona.
d. Progress Report, Arizona Agricultural Experiment Station. 1951-52.

University of California

I. Technical Personnel: P. W. Gregory*, H. R. Guilbert, Wade Rollins, N. R. Ittner, K. A. Wagnon, F. D. Carroll.

II. Title of Project: The Improvement of Beef Cattle Through the Application of Breeding Methods (Revised 1948).

III. Object: To develop lines of beef cattle that will result in improvement in such characters as rate and economy of gain, fertility, nursing ability, longevity and carcass quality.

IV. Work Progress: Weight records have been gathered on all animals produced in the University of California herd since 1929. Since 1941 body measurements have been taken on all animals. On the San Joaquin Experimental Range similar measurements have been taken on all animals at weaning time each year up to six years of age. Individual feeding tests on bull calves have been conducted since 1946. This herd has been built to a high level of productiveness and efficiency during the last fifteen years by selection on the basis of production records and the use of sires from the parent herd at Davis.

Of the 120 head of breeding cows, 30 to 60 head are used to test bulls from the Davis herd and to provide get of sire steer groups for progeny testing of sires which have efficiency of feed use records. Individual performance records are available for all breeding cows and for all bulls used in this herd.

The Brown Swiss, Hereford and Braford females at the Imperial Valley station are part of the study of the anatomical and physiological characteristics of the breeds, types and classes in relation to their performance to the end that the industry may be given more specific information upon which adapted strains or eventually breeds might be formed by cattle breeders.

The Herefords and Brafords have been bred to a Charollais bull.

The Brown Swiss are being studied in relation to their adaptability to this hot climate from the standpoint of both beef and milk production.

Data have been collected on body measurements before slaughter, carcass measurements after slaughter, percentage of wholesale cuts, and composition of rib sample from 40 head of cattle at Davis in addition to those slaughtered from the Imperial Valley Station.

Feed utilization tests on bull calves from the Davis herd have been continued. Thirteen individual feed utilization tests on bulls, along with feeding tests of two get-of-sire groups consisting of ten head of steers each, have been completed (1951).

A study of individual heat tolerance variation was made on most of the females of breeding age in the Davis herd. Hair samples and some felting tests were also obtained.

V. Results:

1. An analysis of genetic and environmental factors affecting pre-weaning growth of Hereford calves has been made for the University of California purebred herd maintained at the college farm in Davis. Monthly weights to weaning (8 months of age) were available for 215 calves dropped during the years 1941 through 1951. The calf's rate of growth was analyzed for two periods, birth to 4 months and 4 months to 8 months. The estimated rate of growth of a calf for each period is a linear regression coefficient (pounds gain/day) based on 5 monthly weighings. The rate of growth from birth to 4 months is designated as $b_1$, and that from 4 months to 8 months as $b_2$. For the unadjusted data the average $b_1$ was 1.90 with a standard deviation of 0.33 while for $b_2$ the average was 1.81 with a standard deviation of 0.40.

Adjustment of the data for sex, age of dam, season and year of birth, reduced the variance of individual rates of gain approximately 41 percent for $b_1$ and 61 percent for $b_2$.

A variance and covariance analysis of $b_1$ and $b_2$ for paternal 1/2 sibs, maternal 1/2 sibs and full sibs suggests the following hypothesis: The growth mechanism and the genetic factors affecting it for the period birth to 4 months are significantly different and independent of the mechanism and genetic factors operating for the period 4 months to weaning. A possible explanation for this may be that the principal variation in genotype for rate of growth for the period birth to 4 months may be concerned with the calf's vigor and adaptability to postnatal conditions; while for the period 4 months to 8 months, genotypic differences for ultimate size and rate of maturity may be the principal source of genetic variation in rate of growth.

Pursuing this line of analysis and taking the correlation and regression estimates of $b_1$ and $b_2$ between dams and within dams at their face value it follows that the correlation of a dam's milking ability in periods 1 and 2 is in excess of 75 percent. This could imply a high level of persistency in the dam's lactation during the 8 months to weaning.

A repeatability estimate of 37 percent (for $b_1$) and 26 percent (for $b_2$) for the rate of growth of a cow's calf is within the range of similar estimates for beef cattle reported in the literature. However, such a comparison should be made with some caution since this estimate is for cows mated to the same bull and these records may reflect a certain amount of selection since steer calves were not included. This latter point may imply that for completely unselected records the repeatability estimates might have been somewhat higher.

2. There is no fundamental relation between size as such and efficiency of feed utilization; therefore, rate of gain alone is not a satisfactory index of efficiency. Medium size, generally, however, has greatest range of adaptability and usefulness and meets present market requirements under practical production conditions.

3. If weight-for-age is combined with judicious grading which estimates rate of maturity and development in the desired direction, then it is a good practical index of efficiency. This concept along with data on reproduction and lactation is the basis of records of performance presently

V. Results: (Continued)

being used by breeders cooperating with the Extension Service. The grading system developed is used as a standard in the Red Bluff Bull Sale.

4. The maximum difference at current prices in "cut out" value of cattle varying from good to choice as feeders and fed to "good" slaughter condition has been between $1 and $2 per 1,000 pounds live weight. This applies also to cattle differing so much in conformation as Herefords, Hereford-Brahman crossbreds and Brahmans. Thus, an animal may differ markedly in outward appearance without great change in proportion of meat cuts or percentage of meat to bone.

5. Variation in dressing percentage of animals having equal weighing condition and finish have at current prices resulted value differences of $10 to $12 per 1,000 pounds live weight.

6. The feed required to produce 100 pounds gain with animals fed to equal finish have commonly varied from 650 to over 800 pounds. This can easily mean a difference in feed cost of $10 or more per head during the finishing period alone.

7. It appears that the 1 and 2 dollar items have been overemphasized and the 10 dollar items given too little attention. The data suggest that selection of beef cattle should emphasize more "good doing" cattle that are well balanced in conformation with smooth, firm, trim bodies, with more length in relation to depth than is currently fashionable and which have the ability to produce a carcass yield of 60 percent or more at moderate degrees of finish.

VI. Animal Inventory:

Davis

| | 1 year and older | | | Calves | | |
|---|---|---|---|---|---|---|
| Breed | Females | Bulls | Steers | Females | Bulls | Steers |
| Hereford | 67 | 25 | 5 | 14 | 17 | 5 |
| Angus | 10 | 4 | 2 | 2 | 4 | 0 |
| Crossbreds (H x A) | 16 | 1 | 2 | 5 | 1 | 1 |

San Joaquin Experimental Range

| | Herefords (Unregistered) |
|---|---|
| Cows | 113 |
| 2-year-old heifers | 24 |
| Yearling heifers | 43 |
| Yearling steers | 23 |
| Weaner calves | 96 |

VI. Animal Inventory: (Continued)

Imperial Valley Station

| | |
|---|---|
| 2-year-old Braford heifers | 12 |
| 2-year-old Hereford heifers | 9 |
| 2-year-old Brown Swiss heifers | 10 |

VII. Facilities:

Davis:

180-200 acres capable of supporting 200 animal units yearlong. Buildings: Beef cattle barn and experimental feeding barn equipped with twelve individual feeding stalls, four lots for group trials and metabolism stalls for four animals. Additional working corrals and equipment planned in connection with new barn equipped with removable panels for 24 individual feeding stalls or four lots for group trials in addition to hay storage and herd feeding facilities. Chemical and physiological laboratory facilities, psychrometric room for environmental studies and respiration calorimeter are available in the Animal Science Building.

San Joaquin Experimental Range:

4,700 acres of Sierra-Nevada Foothill Range owned by the California Forest and Range Experiment Station.
Corrals and other facilities for properly handling livestock.

Imperial Valley Field Station:

160 acres for cattle pasture.
Corrals and other facilities for handling beef cattle.

VIII. Manuscripts:

Ittner, N. R., H. R. Guilbert and F. D. Carroll. Investigations on Rate and Efficiency of Gain, Carcass Value and Climatic Adaptability of Hereford, Brahman, Hereford x Brahman and Hereford x Shorthorn Crossbred Cattle. Progress Report, Imperial Valley Station. 1948-1951.

Kidwell, J. F., and H. R. Guilbert. A Recurrence of the Semi-Hairless Gene in Cattle. Journal of Heredity, 41:190-192. 1950.

Guilbert, H. R., and P. W. Gregory. Some Features of Growth and Development of Hereford Cattle. Journal of Animal Science, 11:3-16. 1952.

Kidwell, J. F., P. W. Gregory and H. R. Guilbert. A Genetic Investigation of Allometric Growth in Hereford Cattle. Genetics, 37:158-174. 1952.

University of California

I. Technical Personnel: P. W. Gregory*, W. C. Rollins, F. D. Carroll, G. P. Lofgreen, Kathleen Green, W. S. Ware, A. J. Thayer, Norman Freed.

II. Title: Genetic Control of Hereditary Deficiencies in Beef Cattle with Special Emphasis on Dwarfism.

III. Object:

1. The identification of potential dwarf producers from specific body measurements obtained from dwarfs, heterozygotes and homozygous normal animals. Critical data are being collected in the field from many herds.

2. Obtain critical data from sons and daughters, from two to twenty-four months of age, of proven homozygous and heterozygous sires. Check evidence for segregation and nature of segregation in the progeny of each sire. Added to this can be progeny tests of all bulls and heifers that go into herds that can provide progeny tests for a definite proving.

3. Correlate juvenile body measurements with mature phenotypic expressions of dwarfisms. Measurements at one to two months of age, three months, weaning, twelve months, eighteen months, and later if necessary.

4. Complete analysis of hereditary and environmental factors affecting head form. Include study of identical twins. Data from 2. and 3. above can also be used in this analysis.

5. Comparison of heterozygous with homozygous normal. Data from slaughtered animals.

   a. Study comparative anatomy of head.

   b. Correlate anatomy of head more closely with the head contours.

   c. Check endocrine responses of the two genotypes. (The thyrotropic hormone of the heterozygote should show less response and thus agree with the head contour. This will also give a check on penetrance and expressivity in the heterozygote.) These data are to be collected in the field in collaboration with the USDA Beef Breeding Program. The assays will be made in our laboratory.

6. Comparison of endocrines of dwarfs.

   a. Bulls.

   b. Steers.

   c. Heifers.

7. Metabolism, feed utilization and slaughter tests of homozygous and heterozygous animals. (Animals especially produced for this study.)

III. Object: (Continued)

a. Compare metabolism.

b. Compare efficiency of feed utilization.

c. Compare slaughter grades, dressing percent, percentage cuts of carcass, etc.

d. Compare endocrines of the two genotypes.

If heterozygotes have a slightly lower basal metabolism (than homozygous normals), with other things equal they may use feed more efficiently and may have other characteristics that would be desirable or economical in beef production. Thus, the dwarf gene in the heterozygous state may actually enhance beef production. If this should prove to be true, the gene could be used to advantage by commercial cattlemen if losses from recessive dwarfs can be eliminated.

8. Allometric study of dwarfs. This study may lead to the development of new diagnostic characters for identifying heterozygotes and homozygous normals.

9. Identify the different genes that condition dwarfism in all the beef breeds. (Tests are now under way).

10. Gene-frequency analyses in all the breeds involved.

11. Explore the possibility of using mutant dwarf stocks of laboratory animals (rats, mice, rabbits, chickens, etc.) as assay material for identifying specific endocrine deficiencies that may be present in the various dwarf types of cattle.

12. Exploit any pertinent problems that may arise as a result of these investigations.

IV. Work Progress:

The Hereford type of dwarf.

1. More accurate location has been made of three critical diagnostic points on the head profile that are necessary in determining dwarf-carriers. The parietal-frontal juncture (PFJ) and the midforehead point (MFP) can be located arithmetically on the basis of total head length. The nasal-frontal juncture (NFJ) can also be located arithmetically if it cannot be determined from the profile itself.

2. The heights of PFJ, MFP and MFJ above the base line all have diagnostic value in identifying dwarf-carrier and homozygous normal bulls.

3. In mature bulls (30 months of age or older) a study of approximately 100 animals of known genotype permits the following conclusions:

a. The dwarf gene consistently increases the height of the midforehead point above the base line on the head profile.

IV. Work Progress: (Continued)

b. In animals with "flat" heads at the same time that the dwarf gene increases the height of MFP, it decreases the height of PFJ.

c. In animals with "dished" heads, the dwarf gene consistently increases the height of the MFP and it also decreases the height of the NFJ.

d. Thus, in "flat headed" bulls of normal phenotype, dwarf-carriers can be identified from the relationship of MFP to PFJ, while in bulls manifesting marked dish, carriers of the dwarf gene can be identified from the relation of MFP to NFJ. The genotype of bulls that are somewhat intermediate in dish may be determined from the relation of MFP to either PFJ or NFJ.

4. The data at hand indicates that in mature bulls it should be possible to identify the genotype of 90 percent or more from the head profile and head length.

5. Predicting the genotypes of mature bulls from the head profiles and head measurements has been successful. Predictions have been made on about 70 animals whose identity was completely unknown to the members of the laboratory where the profiles were classified. Of these, 20 had been proved by progeny tests. The prediction from the profiles was 15 dwarf-carriers and 5 homozygous normals. This was in complete agreement with the results of the progeny tests. Predictions are now being made from profiles and head data sent in by collaborators from other States. The first were made on profiles of bulls obtained by Professor Galgan at Washington State College. The predictions on the four that had been proven were 3 dwarf-carriers and 1 homozygous normal. This was, again, in complete agreement with the results of the progeny tests.

6. A simple key has been prepared that makes possible the identification of heterozygous and homozygous normal genotypes from the median head profile and head length. The time required (after the profile is obtained) is only a few seconds.

7. Heterozygous (dwarf-carrier) bulls reach their mature body proportions earlier than homozygous normal bulls. This is a potent factor in selection and the favoring of the heterozygote.

8. Other, different morphological types of dwarfs have been studied. The "long headed" type commonly found in Angus and reported by Baker et al (1951) and a different type found in Shorthorns but not yet reported have both been found to be deficient in the thyrotropic hormone of the pituitary.

9. On morphological grounds there appear to be at least 6, or perhaps more, different types of hereditary dwarfs.

Physiology Studies

1. Histology slides have been made of pituitaries, adrenals, and thyroids from Hereford, Angus and Shorthorn dwarfs.

IV. Work Progress: (Continued)

2. Pituitaries from Angus and Shorthorn dwarfs have been tested for thyrotropic hormone.

3. Pituitaries from Hereford dwarfs have been tested for growth hormone.

4. Pituitaries from heterozygous and homozygous normal Hereford bulls have been tested for thyrotropic hormone.

V. Results:

1. The dwarf gene in the heterozygous state affects the head profile of mature bulls, causing a condition intermediate between those of the two homozygous types.

2. In mature bulls, the penetrance of the dwarf gene in the heterozygous state with regard to the head profile is probably complete in heads manifesting Class II and Class III profiles. Thus, heterozygous and homozygous normal genotypes can be recognized with an accuracy of 90 percent or higher. Class I profiles are so rare that no attempt has been made to break them down into heterozygous and homozygous components.

3. In mature bulls, the relations of the diagnostic points PFJ, MFP and NFJ of the profile are significantly different in the recessive dwarfs, heterozygotes and homozygous normals.

4. These differences are of sufficient magnitude to allow one to recognize heterozygous and homozygous normal genotypes with a high degree of certainty.

5. The dwarf gene has some expression in males under thirty months of age but the age at which it becomes manifest is yet to be determined.

6. In females, the dwarf gene has some expression in the heterozygous state but on the whole it is less marked than in the males.

VI. Animal Inventory:

| | Herd Bulls | Cows | Yearling Heifers | Yearling Bulls |
|---|---|---|---|---|
| Hereford (Dwarf) | 1 | 2 | 6 | 2 |
| Hereford (Heterozygous for Dwarfism) | 0 | 13 | 0 | 0 |
| Angus (Dwarf) | 2 | 3 | 1 | 0 |
| Shorthorn (Dwarf) | 0 | 1 | 2 | 1 |

VII. Facilities:

Davis: 50 acres of hay and pasture; corrals, barn space, scales, etc. Research laboratories for genetics, physiology, biochemistry and anatomy.

VIII. Manuscripts:

Carroll, F. D., and P. W. Gregory and W. C. Rollins. Thyrotropic Hormone Dificiency in Homozygous Dwarf Beef Cattle. Journal of Animal Science, 10:916-921. 1951.

Gregory, P. W., W. C. Rollins, P. S. Pattengale and F. D. Carroll. A Phenotypic Expression of Homozygous Dwarfism in Beef Cattle. Journal of Animal Science, 10:922-933. 1951.

Gregory, P. W., S. W. Mead, W. M. Regan and W. C. Rollins. Further Studies Regarding Sex-Limited Genetic Infertility in Cattle. Journal of Dairy Science. 34:1047-1055. 1951.

Gregory, P. W., S. W. Mead and W. M. Regan. A Genetic Analysis of Prolonged Gestation in Cattle. Portugaliae Acta Biologica Series A - R. B. Goldschmidt. Volume 861-882. 1951.

Gregory, P. W., W. C. Rollins and F. D. Carroll, 1952. Heterozygous Expression of the Dwarf Gene in Beef Cattle. Southwestern Veterinarian (in press).

Gregory, P. W., and B. B. Brown, 1952. A Profilometer for Studying Head Form of the Bovine. Journal of Animal Science (in press).

Colorado Agricultural Experiment Station and Fort Lewis A. & M. College

I. Technical Personnel: H. H. Stonaker*, S. S. Wheeler, J. E. Ingalls, M. H. Hazaleus, T. R. Blackburn, F. X. Gassner.

II. Title of Project: Improvement of Beef Cattle Through Breeding. I. A Comparison of Comprest and Conventional Types of Hereford Cattle Under Range and Feed-Lot Conditions. II. A Study of Inbreeding and the Crossing of Inbred Lines Within the Hereford Breed.

III. Objects:

Sub-Project I:

a. To compare the performance of comprest and conventional type breeding cows and bulls under the range conditions in the Fort Lewis, Colorado area.

b. To compare the performance of comprest and conventional type feeder steers while being fattened in the Colorado A. & M. feed-lots at Fort Collins.

c. To compare the carcass characteristics of comprest and conventional types.

d. To procure additional information on the inheritance of the comprest character through various matings.

Sub-Project II:

a. To study the effect of intensive inbreeding on various traits in beef cattle, such as type, size, rate and efficiency of gain, fertility, color, and production of abnormalities.

b. To study the effect on these traits of crossing inbred lines.

c. To determine how inbred lines may best be utilized in producing the maximum amount of hybrid vigor.

d. Additional information which may be obtained from the experiment.

1. The mode of inheritance of the comprest trait.

2. The correlation between a sire's own performance and that of his progeny.

3. Heritabilities of measurements and observations taken on the parents and offspring.

4. The relative economic and genetic importance of such factors as type, efficiency and rate of gain, carcass grade, fertility and nursing ability in determining the profitableness of different beef animals. A selection index for beef cattle may be developed from such an analysis.

III. Objects:
Sub-Project II: (Continued)

5. The amount of selection that is actually practiced for growth rate, efficiency of gain, type, carcass grade and fertility, while developing inbred lines.

6. The effectiveness of selection against the fixation of undesirable characters.

7. Variation within lines and between lines as affected by increased inbreeding.

IV. Work Progress: Sixteen lines of Hereford cattle (2 Polled Hereford) have been established.

The methods of measuring record of performance at Colorado A & M College are largely adaptations of methods used at the Miles City Station and elsewhere - a few innovations have been made. At present our principle objectives in performance are:

a. Cow herd - cows which will raise calves with heavy weaning weights and high grades per unit of maintenance cost in the cow herd.

b. Feeder cattle - heavy gains of high quality per unit of fattening cost.

Measures which will be most useful in the evaluation of animals are not yet definitely ascertained. We are taking the following data on the herds until it is learned which observations are most useful. Some of the observations provide material for incidental studies such as the inheritance of hair color. Blood type is obtained for all animals in the project.

Observations on the breeding herd:

Birth - heart girth measurement, grade

July 1, September 1, December 1 - weights and grades on all animals in the breeding herd.

December 1 - photographs of all animals behind grid. Color markings, pattern of pigmentation about eyes, hair sample.

Winter - cows are lotted according to type and age. Hay consumption and weight are recorded at 28-day intervals.

Steer feeding

For the type study, steer calves were fed in individual stanchions designed much like the old-fashioned wooden stanchions used in dairies. The stanchion was used only to restrain the animal until his neck chain could be snapped to the bunk. The animals were chained to bunks from 4:00 p. m., until 8:00 a. m. They were given all they would eat during this period. Each steer had a feed storage barrel into which his feed was weighed. He was fed from the barrel, and the feed weighed back every 14 days. Daily feed weights were not taken.

Observations on steers

Measurements - 19 body measurements were taken on steers every 28 days. Duplicate measurements were taken.

Scores and weights - steers were graded, using feeder market grades, at the beginning. BAI scoring sheets were used at the end of the experiment. Steers were weighed every 28 days.

Photographs - steers were photographed behind a grid at the beginning and end of the experiment. They were slaughtered when they reached what was judged to be a constant degree of finish at a grade of high good to low choice. It was felt that for the purpose of evaluating large differences in steer sizes, time or weight, constant feeding periods would not be a more satisfactory criterion.

Observations on carcasses

Detailed measurements, weights of wholesale cuts, tracing of rib eye, sample separation of lean, fat and bone were taken according to methods described by the BAI.

Photographs of carcasses, loins and rounds were taken. The thyroids, adrenals, and pituitaries are preserved for histological examination and bioassay.

Basis of Selection

At present, the first evaluation of cow and calf performance is derived from grades and weights of calves at 200 days of age. In order to give equal economic value to weight and grade (based on Minn. Exp. Sta. Tech. Bul. 94) one standard deviation in grade is considered to be equal to one standard deviation in weight. At Colorado this means that 50 lbs. difference in weight is equivalent to about .8 difference in score. (6 = fancy, 5 = choice, 4 = good, 3 = medium, 2 = common).

It is hoped that it will be possible to continue retaining all heifers for the production of one calf before a culling is made.

Bulls are now being selected on the basis of their weaning performance, their feedlot efficiency, and grade as yearlings. It is not known as yet how much value to give to each of these measures, but it is thought that giving feedlot efficiency and yearling grade about equal weight with each of the two variables taken at weaning may be a reasonable "rule-of-thumb" for selection at the present.

Phase I of the project has been completed and the results are being published as analysis is completed.

V. Results:

Comprest cattle utilize feed as efficiently as larger types on wintering or fattening rations. Individual feeding of steers for three trials indicates no significant or consistent differences in pounds of feed required to make a pound of gain. Small type steers graded good and were slaughtered

V. Results: (Continued)

at 692 pounds body weight, conventional type at 848 pounds. Daily gain for the small type was significantly lower than for conventional type (1.75 lbs. - 2.13 lbs.)

Two years wintering with Hereford females of different types and ages indicates considerable correlation between size of cow and total amount of hay needed for wintering. Cows of similar ages appear to require about the same amount of hay per unit of body weight, regardless of size.

Endocrinological work indicates that TSH content of the pituitaries of comprest steers is greater than that for conventional type. The histology of the thyroids indicates a slight hyper-activity in the comprest steers.

Comprest carcasses are 20 percent lighter when finished but proportions of carcasses in major cuts are the same as the larger steers.

Comprest appears to be due to a single factor (partially dominant). Comprest is the heterozygote; the homozygote is dwarf and semi-lethal.

The lines now being developed are showing differentiation of blood antigens as well as other traits.

VI. Animal Inventory:

| | |
|---|---|
| Hereford | |
| Bulls | |
| One year or over | 76 |
| Calves | 77 |
| Females | |
| Two years or over | 202 |
| Yearlings | 64 |
| Calves | 75 |

VII. Facilities:

Fort Lewis
- 6,000 acres pasture, corssfenced.
- 300 acres hay land.
- 12 lots for handling and sorting.
- 2 sheds for individual feeding.
- 1 feed storage and mixing building.

Colorado A. & M.
- 1,500 acres pasture.
- Sheds and lots for feeding.
- Laboratories.
- Statistical laboratory.

VIII. Manuscripts:

Stonaker, H. H., Willard Taussig, Harold Taussig. Like Only Tends to Beget Like. American Hereford Journal, October 1947.

VIII. Manuscripts: (Continued)

Stonaker, H. H., W. C. Connell, S. S. Wheeler. Gains Plus Type Equal Profitable Cattle. American Hereford Journal, October 1947.

Stonaker, H. H., M. H. Hazaleus, S. S. Wheeler, J. E. Ingalls and E. W. Schleicher. Feedlot and Carcass Characteristics of Small and Conventional Type Cattle. Colorado Agricultural Experiment Station Progress Report, March 1950.

Safley, C. E. A Comparison of Comprest and Conventional Type of Hereford Steers as Evaluated by Body and Carcass Measurements. Thesis (M. S.) 1950.

Schleicher, E. W. Variations in the Characteristics of Carcasses from Comprest and Conventional Types of Hereford Steers. Thesis (M. S.) 1950.

Lucas, Kenneth. Relationship of Thyroid, Adrenal and Pituitary Weights to Body Development in Comprest and Conventional Types of Fat Hereford Steers. Thesis (M. S.) 1950.

Ingalls, J. E. Comparative Feedlot Performance of Individually Fed Purebred Hereford Steers of Comprest and Conventional Type. Thesis (M. S.) 1950.

Schleicher, E. W., H. H. Stonaker, M. H. Hazaleus and S. S. Wheeler. Feedlot and Carcass Characteristics of Small and Conventional Types Hereford Steer Calves. Proceedings Western Section Society of Animal Production. 1950.

Lucas, K., F. X. Gassner, H. H. Stonaker and S. S. Wheeler. Relationship of Thyroid, Adrenal and Pituitary Characteristics to Body Development in Small and Conventional Types of Fat Hereford Steers. Proceedings Western Section Society of Animal Production. 1950.

Safley, C. E., H. H. Stonaker and S. S. Wheeler. A Comparison of Small and Conventional Types of Hereford Steers as Evaluated by Body and Carcass Measurements. Proceedings Western Section Society of Animal Production. 1950.

Stonaker, H. H. A Unique Herd of Hereford Cattle. Heredity 42:207-209. 1951.

Holland, L. A. Selection Index for Hereford Feeder Calves. Thesis (M. S.) 1951.

Stonaker, H. H., M. H. Hazaleus and S. S. Wheeler. Feedlot and Carcass Characteristics of Individually Fed Comprest and Conventional Type of Hereford Cattle. Journal of Animal Science. 11:17-25. 1952.

Stonaker, H. H., J. E. Ingalls and S. S. Wheeler. Winter Hay Consumption of Breeding Females of Large, Intermediate and Comprest Types of Hereford Cattle. Journal of Animal Science. 11:26-33. 1952.

## Hawaii Agricultural Experiment Station

I. Title: The Improvement of Beef Cattle Through the Application of Breeding Methods.

II. Technical Personnel: Oliver Wayman* and L. A. Henke.

III. Object:

1. The development of inbred lines of beef cattle that will be useful in the improvement of such characters as rate of gain, economy of gain, carcass quality, fertility and longevity.

2. To develop effective breeding techniques for improving the productiveness of beef cattle.

3. To investigate the productiveness of existing lines of beef cattle.

IV. Work Progress:

In June 1950, Dr. R. T. Clark, National Coordinator of Beef Cattle Research, at the request of the Hawaii Station, visited the Territory and in company with Animal Husbandmen of the Hawaii Station visited the major beef ranches on Hawaii, Maui, Kauai and Oahu. The objectives and procedures for a beef cattle improvement plan were discussed with the ranchers. The proposed project was accepted by the ranchers and in January 1952 Dr. Clark returned to the Territory to complete final arrangements for the program.

The initial phases of the project include five cooperating ranches with animals organized into 20 herds. Each cooperator has scales, corrals and facilities for handling the work. This project is designed for testing animals on grass alone during their entire life. In some cases, cooperators have slaughter facilities and will obtain critical carcass data in addition to other performance factors.

Data obtained on all animals include:

1. Individual number and sex.
2. Sire and dam.
3. Birth date.
4. Weaning weight and grade.
5. Subsequent weights and grades at 12, 18 and 24 months for animals retained in the breeding herd.

Replacement bulls will be selected on the basis of individual performance and progeny test on grade females.

V. Results:

Ranchers cooperating in the program at the present time have indicated a desire to increase their cooperating herds as soon as possible.

VI. Animal Inventory:

Registered Herefords:

| | |
|---|---|
| Bulls | |
| Horned | 12 |
| Polled | 8 |
| Cows | |
| Horned | 69 |

Grade Herefords

| | |
|---|---|
| Cows | |
| Horned | 120 |
| Polled | 280 |
| Heifers | |
| Horned | 170 |

VII. Facilities:

Adequate scales, corrals and facilities to properly handle the animals. In addition, some ranches have slaughter facilities to enable them to obtain carcass data.

University of Idaho

I. Technical Personnel: C. F. Sierk*, T. B. Keith, R. F. Johnson, C. W. Hickman, W. P. Lehrer, Jr., and C. W. Hodgson.

II. Project Title: The Improvement of Beef Cattle Through the Application of Breeding Methods: (1) Linebreeding Within the Hereford and Shorthorn Breeds, (2) By testing linebred sires within various lines which will be developed.

(a) Sub-Project: Performance Testing of Bull Calves of Purebred Beef Herds of the State.

III. Object:

(1) To test and locate promising lines or strains or combinations thereof for efficiency of feed utilization of cooperating purebred beef cattle breeders and develop methods of expanding useful lines or strains through the cooperation of the breeder.

(2) To develop a system of performance recording on ranches in order to (a) locate superior foundation stock, (b) aid owners in selecting breeding stock, and (c) obtain data on the performance of lines or strains or combinations thereof.

IV. Work Progress: Efficiency testing of bulls from the University of Idaho as well as breeders in the State has been undertaken.

A thorough study of the effects of varying concentrate/roughage ratios on rate and efficiency of gain has been in progress and preliminary results are now being analyzed. The effect of various protein levels in the ration of individually fed animals is also being studied.

V. Results: The differences found in feed efficiency of bulls tested from individual breeders as well as University bulls indicates that individuals and blood lines may be located that have the ability to utilize feed efficiently. These studies show that variation can be found in all performance factors whenever and wherever it is looked for.

VI. Animal Inventory:

| | |
|---|---|
| Angus | |
| Bulls | |
| 1 year or over | 4 |
| Calves | 5 |
| Females | |
| Cows - 2 years or over | 14 |
| Yearlings | 3 |
| Calves | 6 |
| Total | 32 |

VI. Animal Inventory: (Continued)

Hereford

| | |
|---|---|
| Bulls | |
| 1 year or over | 6 |
| Calves | 7 |
| Females | |
| Cows - 2 years or over | 39 |
| Yearlings | 9 |
| Calves | 10 |
| Total | 71 |

Shorthorn

| | |
|---|---|
| Bulls | |
| 1 year or over | 5 |
| Calves | 4 |
| Females | |
| Cows - 2 years or over | 22 |
| Yearlings | 5 |
| Calves | 12 |
| Total | 48 |

VII. Facilities:

Moscow

1. Main barn, 120 feet by 60 feet.
2. Three loafing sheds.
3. New experimental feeding barn with 18 individual stalls plus feeding equipment, scales, etc.
4. Pasture for entire herd.

Caldwell

Eight lots with 80 individual feeding stalls, 7 lots for group feeding, scales and feeding equipment.

VIII. Manuscripts:

Keith, T. B. - - - - - - - - - - - - . Stall Equipment for Experimental Steer Feeding. Agricultural Engineering. 31:622. 1950.

U. S. Range Livestock Experiment Station, Miles City, Montana

I. Technical Personnel: J. R. Quesenberry and R. R. Woodward.

II. Title: Identification and Propagation of Genetically Superior Lines of Beef Cattle. Testing Breeding Values of Lines of Hereford Cattle.

III. Object: To improve beef cattle production with respect to quality and efficiency through use of sib tests and progeny tests in predicting breeding value of lines and combinations of lines of beef cattle and through propagation and distribution of superior lines and combinations.

To establish lines of beef cattle particularly adapted to range conditions and having the following characteristics:

1. High fertility.
2. Capacity to make gains rapidly and economically.
3. High dressing percentage of edible beef of superior quality.
4. Desirable body conformation.

The program will be confined to new phases of beef cattle breeding improvement which are not now included in the regular program of the Bureau. The regular program will continue, as it has in the past, to investigate basic research problems, to furnish information on how to develop better lines and how to stabilize genetic variability. The new program will utilize such information to test, synthesize and put to use in the field, new lines of superior beef cattle. To do this State Experiment Station unrelated lines of Hereford cattle will be sib-tested. Superior lines and combinations of lines will be propagated and distributed through cooperating State Experiment Stations to beef cattle producers for further testing under field conditions.

IV. Work Progress: The United States Range Livestock Experiment Station was founded in 1924 by an Act of Congress which transferred the Fort Keogh Military Reservation from the War Department to the United States Department of Agriculture. This Act made possible experimental work in cooperation with the Montana Agricultural Experiment Station.

The Fort Keogh Military Reservation was established by an Act of Congress in 1876-77, setting aside 100 square miles of land in a block 10 miles square to be known as Fort Keogh, named for Captain Miles Keogh, Adjutant to General Custer. In 1912, Fort Keogh became a Remount Post for the Army and during World War I more horses were processed through Fort Keogh than any other post in the Army. At the end of World War I, the Post was abandoned. In 1924, the land was transferred to the Department of Agriculture.

The station comprises approximately 56,300 acres of land in an area nearly 10 miles square. The reservation is bounded on the east by Tongue River. In the Yellowstone River flat, approximately 1,000 acres are under irrigation. The remainder of the station is rough, broken "badlands," typical of much of the range in eastern Montana. The entire area is fenced and cross-fenced into 52 pastures ranging in size from 30 to nearly 4,000 acres. The facilities allow separate breeding pastures and enough large pastures for spring, summer, fall and winter range.

IV. Work Progress: (Continued)

The station breeds from 600 to 700 cows each year in 20 to 25 breeding herds. Yearling heifers for replacement, steers on feed, and calves, make up the remainder of the inventory. The total may be as high as 2,000 head and may be as low as 1,000 head, according to the time of year. These cattle are all owned by the Montana Agricultural Experiment Station.

A total of 11 lines have been included in the testing program. These lines are as follows:

Line 1: Foundation sires (Advance Domino 20th and 54th) from Fred De Berard, Kremmling, Colorado. Foundation females were Station animals. The genetic history of this line has been published in Montana Experiment Station Bulletin No. 479, 1951.

Line 2: Foundation sire from Banning and Lewis (Dandy Domino 113th). Foundation females were station animals. This line is being discarded.

Line 3: Foundation sires from Taussig Brothers (Mischief Mixer). This line has been discarded.

Line 4: Foundation sires and females from Albert Mitchell, Tequesquite, New Mexico (Husker Mischief).

Line 5: Foundation sires and females from Albert Mitchell (Young Mischief).

Line 6: Foundation sires and females from F. E. Messersmith & Sons, Alliance, Nebraska.

Line 7: Foundation sires and females from F. E. Galt, Willowcreek Ranch, Great Falls, Montana (Trail Blazer 48th).

Line 8: Foundation sires and females from Art Bayers, Twin Bridges, Montana (Evan Mischief).

Line 9: Polled Herefords. Foundation sires and females from Dingwall Brothers, Drummond, Montana (King Domino).

Line 10: Foundation sires and females from Higgins Brothers, Ringling, Montana (Errol Domino).

Line 11: Cross line, 1 x 5.

V. Results:

1. Early in the record of performance program of research it was found that there was little or no association between type of animal and ability to grow. It has been common belief among cattlemen that they could select the faster-gaining, more efficient animals by using conformation characteristics as a criteria. A recent analysis indicates that there is no association between conformation points and ability to gain. Conformation characteristics are inherited, as well as ability to grow, but selection by visual appraisal of feeder calves for ability to gain is ineffective.

V. Results: (Continued)

2. An analysis of data from 181 steers fed out under record of performance methods showed that there were apparent hereditary differences between the progeny of different sires in ability to gain, in weight for age, and in conformation characteristics. The results of feeding tests during 1948-49 of 8 steers from each of 13 bulls are indicative of the variation that may be expected during most years.

Between the best and the poorest progeny groups there was 119 pounds' difference in weaning weight, and 211 pounds' difference at the end of the feeding period. In net returns above feed and marketing cost, there was $45 per head difference between the progeny of the best and poorest bull. On the 8 calves, therefore, the best bull returned $360 more than the poorest bull. Such differences are by no means exceptional, as shown by performance tests at many State experiment stations that are cooperating in this program.

3. The heritability of economic characteristics in beef cattle has been determined. These revised estimates of heritability are:

| | Percent | | Percent |
|---|---|---|---|
| Birth weight | 53 | Weaning score | 28 |
| Weaning weight | 28 | Slaughter steer grade | 45 |
| Weight at 15 months | 86 | Carcass grade | 33 |
| Rate of gain on feed | 65 | Area of eye muscle | 68 |

4. Another project was to determine the advantages of cross-breeding in range herds in the Northern Great Plains area. This study was designed to test the possibility of maintaining hybrid vigor through the use of sires from three beef breeds and of crossbred females for each succeeding generation. The crossbred steers were fed out each generation and compared with the purebred Hereford steers used in record of performance studies. The first generation was the result of crossing Shorthorn bulls on Hereford cows. The second generation resulted from crossing Aberdeen-Angus bulls on first-generation cows, and the third generation from crossing Hereford bulls on second-generation cows. In general, the crossbred steers weighed more at any age, gained more rapidly in the feed lot, had a higher final weight and sold for more per pound than the average of the Purebred Hereford steers. While this is true of the average, it is of scientific and practical interest that in each year of this experiment one or more lines of Herefords were as good as the crossbreds in the economic characters studied, thereby indicating inherent opportunity for effective selection in straight bred cattle. Furthermore, the most useful Herefords consistently sired crossbreds above average in performance, indicating that in order to reach for maximum production in a crossbreeding program, tested sires of the parent breeds should be used.

The crossbred females grew more rapidly and weighed more at any age than the Hereford females. The crossbred females had higher calf-crop percentages than the Hereford cows. The crossbred females made excellent range mothers and the second- and third-generation calves profited as much from the fact that they were out of crossbred females as they did from the fact that they were crossbred themselves. Crossbreeding can be carried on most profitably where the range producer is able to crossbred systematically and where he either feeds his own steers or sells direct to the feeder.

V. Results: (Continued)

5. An analysis of 770 calves from 112 head of cows that had been in the breeding herds at the station for at least 9 years was made to study the efficiency of production of the range cow. Breeding cows reached mature weight at approximately 5 years of age although little change in weight occurred after 3-1/2 years of age. Maximum birth weights of calves were obtained from 4-year-old cows and maximum weaning weights from 6-year-old cows. Male calves averaged 377 pounds at weaning time, or approximately 6 months of age, and were 22 pounds heavier than the female calves of the same age. The best producing years for a range cow are from 4 to 8 years of age.

VI. Animal Inventory:

| a. Line | 1 | 2 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Breed, Hereford | | | | | | | | | | | |
| Bulls | 16 | 0 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 0 | 37 |
| Cows, 2 yrs or over | 158 | 28 | 35 | 32 | 22 | 30 | 16 | 24 | 23 | 17 | 385 |
| Heifers, yrlgs. | 53 | 5 | 10 | 23 | 5 | 11 | 4 | 7 | 9 | 0 | 127 |
| Bull calves | 51 | 16 | 17 | 22 | 8 | 9 | 7 | 11 | 12 | 8 | 161 |
| Heifer calves | 67 | 10 | 11 | 24 | 7 | 10 | 6 | 14 | 5 | 7 | 161 |
| Total | 345 | 59 | 77 | 104 | 45 | 63 | 36 | 58 | 52 | 32 | 871 |

b. Test Herds (unregistered Herefords)

| | |
|---|---|
| Cows, 2 yrs or over | 224 |
| Male calves | 96 |
| Heifer calves | 89 |
| Total | 409 |

VII. Facilities:

56,300 acres of land of which 1,000 acres is hay land and the balance is grazing land divided into 52 pastures, watered by 4 flowing wells, 14 windmills, 13 developed springs, 26 reservoirs and access to Yellowstone and Tongue Rivers.

Two main barns 165 ft. x 65 ft. contain 75 individual stalls and four pens for group feeding with outside connecting paddocks. There are 14 open sheds with feed bunks and outside lots, 2 sets of corrals, chutes and sorting pens on the range and another set at headquarters, two of which are equipped with stock scales.

VIII. Manuscripts:

Knapp, Bradford, Jr., and R. T. Clark. Genetic and Environmental Correlations Between Growth Rates of Beef Cattle at Different Ages. Journal of Animal Science. 6:174-181. 1947.

Knapp, Bradford, Jr., A. L. Baker and R. T. Clark. Crossbred Beef Cattle for the Northern Great Plains. USDA Circular No. 810. 1949.

VIII. Manuscripts:

Knapp, Bradford, Jr. and R. T. Clark. Revised Estimates of Heritability of Economic Characteristics in Beef Cattle. Journal of Animal Science. 9:582-587. 1950.

Woodward, R. R. and Bradford Knapp, Jr. The Hereditary Aspects of Eye Cancer in Hereford Cattle. Journal of Animal Science, 9:578-581. 1950.

Woodward, R. R. and R. T. Clark. The repeatability of performance of several Hereford sires as measured by progeny records. Journal of Animal Science, 9:588-592. 1950.

Knapp, Bradford, Jr. and R. T. Clark. Genetic and Environmental Correlations Between Weaning Scores and Subsequent Gains in the Feed Lot with Record of Performance Steers. Journal of Animal Science. 10:365-370. 1951.

Knapp, Bradford, Jr., Robert C. Church and Alva E. Flower. Genetic History of the Line 1 Hereford Cattle at the U. S. Range Livestock Experiment Station, Miles City, Montana. Montana State College Bulletin No. 479. 1951.

Quesenberry, J. R. Livestock Breeding Research at the U. S. Range Livestock Experiment Station. USDA Agricultural Information Bulletin No. 18. 1951.

Montana Agricultural Experiment Station and the
North Montana Branch Station at Havre, Montana

I. Technical Personnel: Fred S. Willson*, A. E. Flower, Joseph J. Urick, F. A. Ralston.

II. Title: The Improvement of Beef Cattle Through the Application of Breeding Methods.

III. Object:

a. The establishment of inbred lines of registered Hereford cattle, both horned and polled, that will result in improvement in such characters as rate and economy of gain, fertility, nursing ability, longevity, and carcass quality.

b. Establishment of an improved herd of registered Angus cattle in which the males are selected on a high level of performance as indicated by standard record of performance procedures.

c. Investigate feasibility of breeding for specific combining ability through recurrent selection.

IV. Work Progress:

The initial phases of the project consisted of establishing lines at the Havre and Bozeman Stations.

Havre Station:
Line 1 (Polled Herefords) foundation females came from the Dingwall Bros. herd, Drummond, Montana. A polled bull from the Rosignol herd, Lolo, Montana, was used as a foundation sire. Rosignol got his sire from Dingwall.

Line 2 (Horned Herefords) foundation animals obtained from the Higgins Bros. herd, Ringling, Montana.

Line 3 (Horned Herefords) foundation animals from the Sim & Schock herd, Highwood, Montana.

High Grade Test Herd: This is a test herd of females graded to Line 1 bulls from the U. S. Range Experiment Station, Miles City, Montana.

Bozeman:
Horned Hereford line: females from the College herd line bred to bulls from a cooperating rancher, Lester Thompson of Bozeman, who has a stable breeding method. Angus herd: Foundation females from Harris Bros. of Bozeman.

Bull calves from the lines at Havre and Bozeman are individually fed and complete individual performance records are kept. At the Havre Station one or more bulls from each line, depending on number of test cows, are used in a test-cross. These bulls are selected on the basis of performance and are mated to females from the Hi Grade test herd. Superior

bulls as determined by their test-cross performance are used as replacement bulls in their own line. Progeny performance in test crosses is based on record of performance of group-fed steer and heifer calves.

Selection of replacement heifers for the registered herds and test line is based on weaning weight, weaning score and dam record with final selection based on performance at 18 months.

In an attempt to locate new sources of breeding stock, cooperating ranchers bring bull calves to the Bozeman Station for bull indexing. These ranchers agree to permit the station to use any bull that has an outstanding record on a limited number of cows in order to establish additional lines.

## V. Results:

Many ranchers in the State are now using a system of bull indexing on their own ranch. Commercial cattlemen are seeking bulls that have been tested for efficiency of gain. Feeder buyers are paying premiums of $2.75 to $3.00 per cwt. for steers from herds that have been using bulls selected for rapid and efficient gain.

Bulls indexed at the Bozeman Station for breeders have shown a difference of from 30 percent to 40 percent in rate of gain for individual bulls.

## VI. Animal Inventory: (As of May 1, 1952)

North Montana Branch Station, Havre, Montana

| Line 1 Polled Herefords | |
|---|---|
| Females, 2 yrs and over | 28 |
| Females, 1 yr old | 6 |
| Females, calves | 8 |
| Bulls, 2 yrs old and over | 2 |
| Bulls, 1 yr old | 10 |
| Bulls, calves | 13 |
| Total | 67 |

| Line 2 Horned Herefords | |
|---|---|
| Females, 2 yrs and over | 27 |
| Females, 1 yr old | 8 |
| Females, calves | 9 |
| Bulls, 2 yrs old and over | 2 |
| Bulls, 1 yr old | 9 |
| Bulls, calves | 10 |
| Total | 63 |

VI. Animal Inventory: (Continued)

Line 3 Horned Herefords

| | |
|---|---|
| Females, 2 yrs and over | 25 |
| Females, 1 yr old | 11 |
| Females, calves | 8 |
| Bulls, 2 yrs old and over | 2 |
| Bulls, 1 yr old | 7 |
| Bulls, calves | 12 |
| Total | 65 |

Hi Grade Test Herd

| | |
|---|---|
| Females, 2 yrs and over | 94 |
| Females, 1 yr old | 32 |
| Females, calves | 42 |
| Steer calves, 1 yr old | 27 |
| Steer calves, under 1 yr | 43 |
| Total | 238 |

Bozeman, Montana

Horned Hereford Line

| | |
|---|---|
| Females, 2 yrs and over | 38 |
| Females, 1 yr old | 8 |
| Bulls, 2 yrs and over | 8 |
| Bulls, 1 yr old | 10 |
| Bulls, calves | 7 |
| Heifer calves | 7 |
| Total | 78 |

Angus Herd

| | |
|---|---|
| Females, 2 yrs and over | 18 |
| Females, 1 yr old | 2 |
| Bulls, 2 yrs and over | 2 |
| Bulls, 1 yr old | 9 |
| Bulls, calves | 2 |
| Heifer calves | 5 |
| Total | 38 |

VII. Facilities: (Land, Buildings, Equipment)

North Montana Branch Station

| | |
|---|---|
| Grazing Land | 7534 Acres |
| Irrigated Lands | 140 Acres |
| Dry Farm Land | 250 Acres |
| Bldgs., Corrals, etc. | |

Bozeman, Montana

| | |
|---|---|
| Irrigated Land | 190 Acres |
| Bldgs., Corrals, etc. | |

VIII. Publications:

Willson, F. S. Beef Cattle Improvement Through Bull Indexing. Montana Stockgrower. June, 1948.

Willson, F. S. Bull Indexing for Beef Cattle Improvement. American Hereford Journal. Herd Bull Edition. July 1, 1948.

Willson, F. S. Livestock Research at the Montana Agricultural Experiment Station. Montana Stockgrower. August, 1948.

Flower, A. E., F. S. Willson, F. A. Ralston. Bull Indexing at Montana State College. Progress Report. May, 1949.

Willson, F. S., A. E. Flower and F. A. Ralston. Bull Indexing as a Tool in Beef Cattle Improvement. Proceedings Western Section American Society of Animal Production. 1949.

Willson, F. S., F. A. Ralston. Proving Bulls Before They Are Used. Montana Farmer Stockman. September 15, 1949.

Flower, A. E., F. S. Willson, F. A. Ralston. Bull Indexing at Montana State College. Progress Report. May 24, 1950.

Flower, A. E., F. S. Willson. Where Can I Buy Indexed Bulls? Montana Stockgrower. October, 1950.

Willson, F. S. "Gain Testing" a Tool for Beef Cattle Improvement. Montana Farmer Stockman. November, 1950.

Willson, F. S. Montana Beef Cattle Production in the Changing 50's. Montana Farmer Stockman. February, 1951.

Willson, F. S., A. E. Flower and F. A. Ralston. Beef Cattle Improvement Through Bull Indexing. Montana Agricultural Experiment Station Mimeographed Circular No. 57. May, 1951.

Willson, F. S. Bull Indexing 1951-52 at Montana Agricultural Experiment Station Progress Report. Part II. Mimeo., Field Day at Montana State College and Fort Ellis Farm. April 18, 1952.

Every year since 1946 there has been at least 1 radio broadcast made over the Montana Networks.

## Nevada Agricultural Experiment Station

I. Technical Personnel: James F. Kidwell*, Lyle McCartney, Cornelius Lingenfelter, Henry Johnson and A. J. Reed.

II. Title of Project: The Correlation of Weight with Age, Conformation, Vigor, and Fertility when Herefords are Moderately Inbred.

III. Object: To develop a line or lines of Hereford cattle that will be useful in producing beef animals that will make more efficient use of available feeds and weigh more at comparable ages than the family lines now produced on ranch and range lands of Nevada and to improve fertility, carcass quality, and longevity of existing Hereford cattle through the use of lines so developed.

IV. Work Progress: Registered Hereford cattle have been purchased for the experimental herd. All animals are weighed every two weeks during the normal grazing season. All male and female calves will be individually fed and animal weights as well as individual feed consumption recorded. Twenty grade females are tested for feed efficiency and those rated highest in the test are used for sire testing.

V. Results: Rate of gain and efficiency of gain by individual animals in the foundation breeding herd was checked under ranch and range conditions. Variations in total gain between animals under identical management and feed conditions exceeded 200 pounds.

VI. Animal Inventory:

Registered Herefords

Males:

| | |
|---|---|
| 3 years | 4 |
| 2 years | 4 |
| 1 year | 4 |
| Calves | 7 |

Females:

| | |
|---|---|
| 3 years | 23 |
| 2 years | 23 |
| 1 year | 24 |
| Calves | 11 |

Grade Herefords

Females:

| | |
|---|---|
| 2 years | 31 |

VII. Facilities:

1. Reno Station:
   a. 210-acre irrigated farm.
   b. Brick and cement cattle barn with hay storage space.
   c. Corrals and scales.
   d. Cattle feeding shed.

VII. Facilities: (Continued)

2. Knoll Creek Field Station:
   a. 2400 acres summer range.
   b. 50 acres hay land.
   c. Hay barn, feeding pens, scales.

3. Fallon Station:
   a. Partial use of feeding pens, scales, etc., for steer feeding and bull testing.

VIII. Manuscripts:

Kidwell, J. F. The Number of Progeny Required to Test a Male for Heterozygosity for a Recessive Autosomal Gene. Journal of Heredity, 42:215-216. 1951.

University of New Mexico

I. Technical Personnel: Ralph Durham*, John Knox.

II. Title of Project: Breeding Beef Cattle for Southwestern Ranges.

III. Objects:

a. To gather information on the heritability of the following characters in beef cattle: weight, grade, rate and efficiency of feed-lot gain, carcass grade and yield, resistance to cancer eye, and type or form.

b. To study the influence of size and type of cattle on: weight and grade of offspring at specific ages, efficiency of feed utilization, market grade and carcass yield, hardiness and reproductive life.

c. To establish procedures or breeding plans to improve range cattle.

d. To develop a line of Purebred Hereford cattle adapted to the southwest.

First Revision: (Revision of objective "b" in original outline)

a. To continue efforts to determine the heritability of type and size.

b. To measure the relative influence of sire and dam on their offspring.

c. To determine the feasibility of mating compact cows with large bulls and large cows with compact bulls.

d. To continue observations on hardiness, longevity and reproductive efficiency of cows on the two types.

Second Revision: (Pertaining to objective "d" of original outline)

a. To develop methods of establishing lines of cattle free of the dwarf genes.

b. To establish a line of Purebred Hereford cattle free of the dwarf gene or, if this proves impossible, a line in which the dwarf gene has a low frequency.

IV. Work Progress:

The Grade Hereford cattle at the Experiment Station Ranch and the registered Herefords at the College farm are included in this experiment. Detailed records are taken on all cattle, including:

1. Date of birth and parentage.
2. Weaning weight and grade.
3. Yearling weight and grade.
4. Mature weight and grade.

IV. Work Progress: (Continued)

5. Feed-lot performance of representative steers from sires used in the grade herd. These records include:
   a. Initial weight and feed-lot gain.
   b. Initial and final feed-lot grade.
   c. Carcass grade and yield.
6. Production records of individual cows.
7. Miscellaneous records such as markings, color, etc.
8. Efficiency of gain of bull calves from the purebred herd.
9. Health records, such as prolapsed uterus, cancer eye, etc.
10. Record of calf mortality.

Three lines are being developed in the registered herd, as follows:

a. A line of general high merit, selected for weight, grade and economy of feed utilization.
b. A line selected for good suckling ability.
c. A line with high resistance to cancer and long period of productivity.
d. Feed consumption by types.

Shortly after this program was started, dwarf calves were born in this herd. Since it was considered unwise to develop superior lines in a herd where dwarfism is known to exist, this plan has been abandoned. At the present time, a dwarf-free line is being developed from known dwarf-free foundation animals.

In the type study, matings are made to produce offspring from:

Compact cows by compact bulls.
Compact cows by large bulls.
Large cows by compact bulls.
Large cows by large bulls.

Complete performance data are being obtained on the offspring to determine the relative merit of the various matings.

A determined effort is being made to study consumption of range forage by different types of cattle. Facilities for collecting feces and other related techniques are being developed in cooperation with the nutrition section.

V. Results:

Work has continued on obtaining data on the relative merits of the different types of cattle being studied, and the associations of various characteristics within these types. Analyses have been completed and published on the heritability of grade and type in range beef cattle, and the correlation between gains made at different periods by cattle.

Feces collections are being analyzed. Early indications are that the feed consumption of the two types is proportional to weight.

A summary of three years' work on the calf-feeding phase of the type study is given in Table 1. There was a significant difference between large and compact types for grade and size, the large type being heavier at weaning but grading less. The feed-lot gain was greater for the large, but not

V. Results: (Continued)

consistently or significantly so, inasmuch as the compact steers gained more in one of the three years. A point of interest is the fact that the compacts gained 8 percent more in relation to their initial weight than did the large.

There appears to be a consistent difference in favor of the compacts in T.D.N. per 100 pounds gain when on feed for 196 days. This difference is not great, but the 1952 calves are apparently going the same way and it appears that difference will be small but real.

A study of the intensity of red color in Herefords indicates a heritability of about 70 percent. Three pairs of genes are estimated to be conditioning the character.

Gain on the range has been found to be correlated with gain in the feedlot. This association is important since the western region is primarily a grass region, and our first need is for good "range" performing cattle.

Studies indicate a heritability of calf grade to be around 25 percent. In view of the fact that other data (as yet unpublished) from this station indicate no correlation between calf grade and carcass grade, the over-all effect of this heritability may not be too great. It is important to know that conformation (as indicated by grade) is inherited, but we need to know more about how to grade calves for potential carcass merit, if that is possible.

There is a highly significant difference in incidence of cancer eye in the progeny of different bulls. Apparently, the difference is not due to variation in the pigmentation of eyelids.

Table 1

LARGE VERSUS COMPACT: AVERAGE OF THREE YEARS

Fed 196 Days

| | Large | Compact | Difference |
|---|---|---|---|
| Average Initial Weight, lbs. | 461.00 | 412.00 | 49 |
| Average Final Weight, lbs. | 866.00 | 806.00 | 60 |
| Average Gain, lbs. | 405.00 | 394.00 | 11 |
| Average Daily Gain, lbs. | 2.06 | 2.01 | .05 |
| Average Initial Grade* | 5.30 | 5.90 | -.60 |
| Average Fat Grade* | 6.00 | 6.10 | -.10 |
| Average Carcass Grade* | 5.20 | 5.30 | -.10 |
| Ratio: Total Gain to Initial Weight | .88 | .96 | -.08 |
| Average Daily Ration, lbs. | | | |
| Ground maize | 8.25 | 7.42 | .83 |
| Cottonseed meal | 1.27 | 1.24 | .03 |
| Corn silage | 9.37 | 8.47 | .90 |
| Alfalfa hay | 4.25 | 3.85 | .40 |
| Cottonseed hulls | .05 | .05 | .00 |
| Totals | 23.19 | 21.03 | 2.16 |
| Ratio: Daily feed consumption to initial weight | .05 | .051 | -.001 |
| Feed for 100 lbs. gain, lbs. | | | |
| Ground maize | 398 | 371 | 27 |
| Cottonseed meal | 61 | 62 | -1 |
| Corn silage | 452 | 424 | 28 |
| Alfalfa hay | 207 | 194 | 13 |
| Cottonseed hulls | 2 | 3 | -1 |
| Total Digestible Nutrients for 100 lbs. gain | 554 | 521 | 33 |

* 8 was highest grade.

VI. Animal Inventory:

| | |
|---|---|
| Hereford | |
| Purebred | |
| Bulls | |
| Two years and over | 9 |
| Yearlings | 3 |
| Calves | 4 |
| Females | |
| Over 2 years | 35 |
| Two years old | 9 |
| One year old | 11 |
| Calves | 6 |
| Grade | |
| Females | |
| Over 2 years | 139 |
| Two years old | 30 |
| One year old | 27 |
| Calves | 60 |
| Steers | |
| One year old | 29 |
| Calves | 63 |

VII. Facilities:

College: Beef cattle barn.
Experimental feeding barn and feed storage unit.
Corrals and scales.
Forty-eight acres irrigated pasture.

Experimental Range: 63,000 acres range.
Corrals and scales.
Feeding pens.
Facilities for feces collection.

VIII. Manuscripts:

Koger, M. and J. H. Knox. The Correlation Between Gains Made at Different Periods by Cattle. Journal of Animal Science, 10:760-767. 1951.

Koger, M. and J. H. Knox. Heritability of Grade and Type in Range Beef Cattle. Journal of Animal Science, 11:361-369. 1952.

Feed Consumption by Two Types of Cattle. New Mexico Agricultural College Ranch Day Report. 1951.

Type and Size Studies in Beef Cattle. New Mexico Agricultural College Ranch Day Report. 1951.

## Oregon State College

I. Technical Personnel:

Central Station: Ralph Bogart*, A. C. Warnick, Hugo Krueger, A. W. Oliver, Fred F. McKenzie, J. J. Dahmen, Martin Burris, George Nelms.

Squaw-Butte-Harney Station: W. A. Sawyer and Farris Hubbert.

Eastern Oregon Station: H. G. Avery and Cecil Pierce.

John Jacob Astor Station and Northrup Creek Station: H. B. Howell and Elmer Dent.

Malheur Station: E. N. Hoffman.

II. Project Title: The Improvement of Beef Cattle Through the Application of Breeding Methods.

III. Object:

1. To determine relative importance of characteristics in a selection program.

2. To determine the inheritance of economic characters.

3. To progeny test beef bulls.

4. To develop a selection index for beef cattle.

IV. Work Progress:

The Oregon Station, composed of the Central Station located at Corvallis and Branch Stations at Astoria, Burns and Union, is developing inbred lines of Angus and Herefords, testing cattle under different environmental conditions, cooperating with breeders in their beef cattle selection programs, and is analyzing data useful to this and other stations.

Line 1, based on the College Aberdeen Angus herd foundation, is being developed at the Central Station. All calves are being fed individually and selection for efficiency of production is applied. Inbreeding of a moderate nature will be followed in this line.

Line 2 (Herefords) at the Central Station is based on the College herd and animals introduced from Earlscourt Farms, Limited (Atok Lionheart) and the Crowe Hereford Ranch (W. C. Domino Prince 59th). This line will be handled as three sub-lines. All animals in this line are performance tested and whenever possible the best bulls are progeny tested.

Line 3 (Herefords) based on Chandler breeding is being developed at the Eastern Oregon Branch Station at Union. All calves in this line will be tested for their performance by feeding them individually.

IV. Work Progress: (Continued)

Cows at Astoria, Burns, Corvallis and Union are being bred to the same bulls by artificial insemination to study the effect of environment upon the performance of calves. These areas vary from heavy rainfall to desert and from low altitude to mountain conditions. The bulls will be evaluated by the performance of their progeny under test feeding as a standard and the influence of environment on the relative productive merits of the bulls can be determined.

A study of the effects of the male hormone on growth, feed, efficiency and carcass characteristics of steers and heifers has been undertaken at the Central Station.

Complete carcass data were obtained on all cattle slaughtered at 800 pounds live weight, including: (a) dressing percentage, (b) weight and percentage of wholesale cuts, (c) carcass grade, (d) weights and measurements of endocrine glands, (e) length of small intestine.

Pilot experiments with small animals are being undertaken that will be of value in beef cattle breeding work. These include the study of the physiological differences between rabbits of large adult size and rabbits of small adult size. Urine, blood and fecal analysis, in addition to other physiological approaches, are receiving attention. The results of various mating systems, as well as the effect of environment on various characteristics, will be studied.

Urine and blood analysis are being determined under comparable conditions for fast and slowly gaining cattle.

V. Results:

1. Developed a record-keeping system which can be used by ranchers and purebred breeders, giving them data on fertility, suckling ability, growth rate, and individual merit, that are needed for proper selection of breeding animals.

2. The correction factor to adjust weaning weight to a common age is 1.29 pounds per day.

3. Birth weight has a significant effect on both rate and economy of gain. Calves larger at birth tend to reach the slaughter weight of 800 pounds at the youngest age with the least feed.

4. No relationship has been found between suckling gains and gains in the feed-lot. The suckling gains do indicate mothering ability of the dam.

5. The age of calf when put on test at 500 pounds had a significant effect on rate of gain during the test. The older calves at 500 pounds gained more per day when they were put on test.

6. The age of calf when put on test did not significantly effect efficiency of gain.

V. Results: (Continued)

7. Weaning score did not have a significant effect on either rate or economy of gain.

8. Selection on an index basis in which equal importance is attached to gains from birth to weaning, gains from 500 to 800 pounds, feed efficiency from 500 to 800 pounds, and individual merit as indicated by conformation score, has resulted in considerable improvement in two lines of Herefords and with little or no change in one line of Herefords and the Angus.

9. The carcass data indicate that there is a sex difference in the percentage of rear quarter in comparison to the front quarter, with the heifers showing more rear development. The addition of male hormone for both heifers and steers had no significant effect upon the relative percentages of the various wholesale cuts.

10. Bulls gain faster and require less feed than steers, and steers in turn are superior in this respect to heifers. It appears that a portion of the difference between heifers and bulls is attributable to the male hormone. Testosterone at a dosage level of 1 milligram per kilogram of body weight per week injected intermuscularly during the test period from a weight of 500 to 800 pounds increased the rate of gain and reduced the feed necessary for making each unit of gain in both heifers and steers. Heifers treated with testosterone responded with a greater increase in rate and economy of gain over the control heifers than did the testosterone treated steers over the control steers. The heifers were not brought up to the level of normal bulls whereas the steers were. The non-masculizing male hormone, Methyl Androstenediol, had no significant effect on rate and economy of gain. Therefore, it appears that these factors are associated with the masculizing principle of the male hormone.

11. Cancer eye seldom, if ever, occurs in "red-eyed" Herefords.

VI. Animal Inventory:

| Line | Herd Bulls | Cows | Yearling Heifers | Yearling Bull |
|---|---|---|---|---|
| Angus | | | | |
| Sunbeam-Barbara | 1 | 19 | 7 | 0 |
| Hereford | | | | |
| Atok Lionheart | 1 | 16 | 4 | 2 |
| W.C. Domino Prince 59th | 1 | 15 | 5 | 1 |
| Oregon David Domino | 1 | 14 | 3 | 1 |

| | | |
|---|---|---|
| Totals: | Bulls | 4 |
| | Cows | 64 |
| | Heifers | 19 |
| | Yr. Bulls | 4 |
| | Calves | 46 |

VI. Animal Inventory: (Continued)

At Squaw-Butte-Harney Cooperative Range and Livestock Branch Station

| | |
|---|---|
| Hereford | |
| Bulls | 3 Purebreds |
| Cows | 30 Grades |
| Calves | 24 Grades |

At Eastern Oregon Branch Experiment Station

| | |
|---|---|
| 3 yr. old Bull | 1 |
| 2 yr. old Bulls | 2 |
| Cows | 11 |
| 3 yr. old Heifers | 3 |
| 2 yr. old Heifers | 6 |
| Yearling Bulls | 7 |
| Yearling Heifers | 5 |

At Northrup Creek Grazing Area

None

VII. Facilities:

At the Central Station: Barn in which 52 calves can be fed individually. Hay shed. Irrigated and other pasture, 80 acres. Research laboratories in genetics and physiology.

At Squaw-Butte-Harney Cooperative Range and Livestock Branch Station: 100 acres, meadow land, sheds, chute and lots for handling livestock.

At Eastern Oregon Branch Experiment Station: Pens for individually feeding 18 calves, corrals, pasture for handling herd.

VIII. Publications:

Sawyer, W. A., Ralph Bogart and M. M. Oloufa. Weaning Weight of Calves as Related to Age of Dam, Sex and Color. Journal of Animal Science. 7:514. 1948.

Bogart, Ralph, and Robert L. Blackwell. More Beef With Less Feed. Oregon Agricultural Experiment Station Bulletin No. 488. 1950.

Blackwell, Robert L. Relation of Rate of Gain to Feed Efficiency in Beef Cattle. Oregon State College Thesis (M.S.) 1951.

Dahmen, Jerome John. Some Factors Affecting Rate and Economy of Gains in Beef Cattle. Oregon State College Thesis (M.S.) 1952.

Warnick, A. C., Ralph Bogart and Ruth Gysbers. Certain Factors Influencing Rate of Gain and Feed Efficiency in Rabbits. Proceedings, Western Section American Society of Animal Production. Volume 2. 1951.

VIII. Publications: (Continued)

Bogart, Ralph, A. C. Warnick, J. J. Dahmen and Martin J. Burris. The Effect of the Male Sex Hormone on Rate of Gain and Feed Efficiency of Beef Cattle. Journal of Animal Science. 10:1073. 1951.

## Utah State College

I. Technical Personnel: James A. Bennett* and Darrell Matthews.

II. Title of Project: Identification and propagation of genetically superior lines of beef cattle: The Improvement of Beef Cattle Through the Application of Breeding Methods:

a. By moderate inbreeding within the Hereford and Shorthorn breeds.

b. By the testing of inbred sires within the various lines which will be developed.

III. Object: To develop lines of beef cattle that will result in improvement in such characters as rate and economy of gain, fertility, nursing ability, longevity and carcass quality.

IV. Work Progress: Individual feeding tests of calves from Hereford and Shorthorn herds are being continued. Additional animals have been purchased for the herds and plans are underway for testing lines for combining ability.

Herefords: A line consisting of 50 - 75 cows has been established with 30 - 40 cows maintained at the Logan Station and the remaining 20 - 25 cows maintained at the Cedar City Station. The line will be operated as a two-sire line. The testing of all male calves will be done under individual feeding conditions. all heifer progenies within the line will be group fed under approved record-of-performance procedures.

Shorthorns: A line of 20 - 25 cows has been established at the Logan Station. It will be operated as a one-sire line under the same R.O.P. procedure as the Hereford line.

The following weight and grade data are taken on all lines:

a. Birth weight.
b. Weaning weight at seven months.
c. Initial, 28-day periodic, and final weights through winter feeding season.
d. Entire herd weighed at beginning and end of grazing season.
e. All calves graded at weaning time and at the end of the winter feeding season.

All-pelleted rations have been used in efficiency trials in an attempt to more accurately determine actual feed consumption.

Antipyrine determinations are being made for animals on ROP test. These animals are being checked periodically during the feeding trial to determine the value of this method in establishing the relative condition of the cattle.

A start has been made to establish a tester strain of Herefords to test new prospective herd bulls for dwarfism before they are used extensively.

V. Results:

1. Results indicate that there is considerable difference in rate of gain and gross efficiency of gain in both bulls and heifers. Bulls gain faster than heifers and are more efficient when efficiency is measured in pounds of gain in relation to pounds of feed.

2. A study of the fluctuation in weight of individual animals during the day indicated that a morning weight taken immediately before feeding was most reliable.

3. Preliminary work with the antipyrine test indicates that this test has definite possibilities for determining differences in condition. The work at this station indicates that in many animals a longer period of time than 2.5 hours is required to make full and uniform distribution and it appears that the first blood sample after injection of antipyrine should not be taken before 3 hours has elapsed.

4. A pelleted ration gives promise of being suitable for feeding test animals and for increasing the accuracy of feed measurements. This work is to be continued.

VI. Animal Inventory:

| | |
|---|---|
| Herefords | |
| Bulls | 18 |
| Cows | 65 |
| Heifers | 13 |
| Calves | 54 |
| Shorthorn | |
| Bulls | 7 |
| Cows | 26 |
| Heifers | 7 |
| Calves | 24 |

VII. Facilities:

Logan Station

1. Individual feeding space for 50 animals.
2. Sheds and corrals for handling breeding herd.
3. Housing and accompanying pens for breeding bulls.
4. Sixty-eight acres of irrigated pasture and fifty-five acres of upland pasture for summer beef pasture.
5. Toledo dial scale and necessary corrals for weighing cattle.

Cedar City Branch Station

1. Sheds and corrals for handling the breeding herd.
2. Twenty acres of irrigated pasture and 600 acres of summer range.

VIII. Manuscripts:

Transtrum, Lloyd G. The Value of Body Measurements of Live Steers as Estimates of Condition, Dressing Percentage and Carcass Quality. Thesis (M.S.) Utah State College. 1951.

VIII. Manuscripts: (Continued)

Potranandana, Saomanas. Comparison of a Pelleted Diet and a Long Hay Concentrate Diet for Record of Performance Tests in Cattle. Thesis (M.S.) Utah State College. 1951.

Various articles in "Utah Farmer" and "Farm and Home Science" concerning the beef cattle testing program.

## The State College of Washington

I. Technical Personnel: M. E. Ensminger*, M. W. Galgan, R. E. Christian and C. R. Kyd.

II. Title of Project: The Improvement of Beef Cattle Through the Application of Breeding Methods: (a) by moderate inbreeding within the Hereford, Aberdeen-Angus and Shorthorn breeds; (b) by the testing of inbred sires within the various lines which will be developed.

III. Object: To develop lines of beef cattle that will result in improvement in such characters as rate of gain and economy of gain, fertility, nursing ability, longevity and carcass quality.

IV. Work Progress: Three lines of beef cattle have been established as follows:

1. Hereford
   Foundation animals, primarily of Wyoming Hereford Ranch origin.

2. Aberdeen-Angus
   Foundation animals from College herd. These animals have been in a linebreeding program.

3. Shorthorn
   Foundation animals of mixed origin.

Data obtained include birth weight, weaning weight, yearling weight, rate of gain, feed per hundred pounds of gain, color in Hereford and Shorthorn cattle, weaning grades and yearling grades for all calves from experiment station herds and private herds that are cooperating in the study. As far as facilities permit, heifer calves and bull calves are individually fed for feed efficiency. Randomized groups of steers from each sire group are also individually fed and carcass data obtained.

A Hereford herd was started at the Prosser Irrigation Experiment Station and calves were placed on individual feeding trial. In addition, bulls from different herds in the State were placed on individual feeding tests at the W.S.C. Beef Cattle Laboratory.

The beef cattle improvement program has been received very favorably by the breeders in the State. With the cooperation of the W.S.C. Extension Service this program is expanded by including all breeders that are interested. Arrangements are being worked out to make use of fair grounds facilities in carrying feeding trials with animals from private herds.

V. Results: From data already analyzed it was found that in only one herd was there a correlation between daily gain from birth to weaning and daily gain from weaning to one year. The correlation between birth and weaning weights was 0.2955, between daily gain and TDN/100# gain in heifers, -0.6407 and in bulls, -0.6010. There was a highly significant difference between herds, between sires and between sex in weaning weights; no difference between breeds and years. Early calves were

V. Results: (Continued)

heavier at weaning than later calves. There was no difference between bulls and heifers in feed efficiency; a highly significant difference existed between herds, between bulls and between breeds in daily gain.

VI. Animal Inventory:

Hereford:

| | |
|---|---|
| Cows, 2 years and over | 18 |
| Heifers, 1-2 years | 5 |
| Calves, heifers | 5 |
| Calves, bulls | 7 |
| Bulls, 1-2 years | 1 |
| Bulls, 2 years and over | 2 |

Aberdeen-Angus:

| | |
|---|---|
| Cows, 2 years and over | 23 |
| Heifers, 1-2 years | 19 |
| Calves, heifers | 5 |
| Calves, bulls | 5 |
| Bulls, 1-2 years | 1 |
| Bulls, 2 years and over | 3 |

Shorthorn:

| | |
|---|---|
| Cows, 2 years and over | 13 |
| Heifers, 1-2 years | 4 |
| Calves, heifers | 8 |
| Calves, bulls | 2 |
| Bulls, 1-2 years | 2 |
| Bulls, 2 years and over | 1 |

VII. Facilities:

Land--200 acres pasture.
Buildings--Beef barn with storage facilities for hay and concentrates.
--Experimental laboratory--facilities for storage and individual feeding for 41 animals.
--Feeding laboratory--facilities for feeding trials for steers and heifers.
--Bull pens--three pens, each with shed.
--Wintering quarters--facilities for main breeding herd.
--Silos, three.

VIII. Manuscripts: Galgan, M. W., C. R. Kyd and M. E. Ensminger. Production Testing of Beef Cattle. Washington Agricultural Station Circular No. 167. 1951.

University of Wyoming

I. Technical Personnel:
Laramie Station: N. W. Hilston*, C. P. Stroble, E. P. Margerum, Joe Biglands.
Gillette Substation: Perry Clay.
Torrington Substation: Leon Paules.

II. Title of Project: The Improvement of Beef Cattle Through the Application of Breeding Methods.

III. Object:

a. To determine if the body score, weight and measurement of calves at weaning time is correlated to the age of dam in the Angus, Hereford and Shorthorn breeds.

b. To determine if body score, weight and measurement of cattle one year and over are correlated to the body score, weight and measurements of their respective dams.

c. To determine whether body score of dam and sire can be used with any degree of accuracy to predict the body score of their progeny.

d. To determine estimates of heritability for those factors considered.

Supplement:

e. To establish a herd of Hereford cattle at the Gillette Substation consisting of two lines, both derived from similar foundation stock but each line to be maintained by different methods of selection.

f. To compare the progeny performance of the two lines as they become genetically stabilized.

g. To furnish material for cytological study.

h. To provide animals for slaughter in order to obtain carcass data.

IV. Work Progress: A herd of Purebred Hereford, Angus and Shorthorn cattle are maintained at the Laramie Station. A line of Purebred Herefords has been established at the Gillette Substation. The following data are obtained on all beef cattle:

1. Length of gestation.
2. Birth weight and score.
3. Weaning weight and grade.
4. Measurements of all animals at weaning.
5. Subsequent yearly weights, measurements and scores on all animals retained in the breeding herd.
6. All animals are photographed at weaning and subsequent weigh periods.
7. Representative animals are slaughtered and complete carcass data are obtained.

IV. Work Progress: (Continued)

In addition, all progeny from the Gillette herd are transported to the Torrington Substation where they are placed on feeding trial.

A blood typing laboratory has been established at the Laramie station. The possible association of blood type with individual performance is being completely explored. Procedures have been considered to use blood type to separate calves into sire groups in commercial herds. A study is also being completed comparing the residual heterozygosity in individual blood type to the calculated coefficient of inbreeding.

The possible use of antipyrine for live animal fat determination is being tested in cooperation with the research chemistry department.

V. Results:

1. An analysis of measurement and performance data of Hereford and Shorthorn steers has shown the following information:

a. Measurements and scores of animals prior to the time they started on feed was not indicative of their ability to gain rapidly or efficiently.

b. Significant differences in the relative yield of wholesale carcass cuts was found between sire progeny groups.

c. A high positive correlation of rate of gain with efficiency of gain was found for all progeny groups.

2. Six animals have been injected with antipyrine and these readings compared with mechanical determinations of carcass fat. It was found that additional work must be done in perfecting the technique of antipyrine injection and in obtaining subsequent samples for antipyrine determination.

VI. Animal Inventory:

Laramie Station:

| | |
|---|---|
| Purebred Hereford | |
| Bulls, 1 year and over | 1 |
| Cows | |
| 2 years and over | 25 |
| Yearlings | 24 |
| Calves | 9 |
| Steers | 22 |
| Purebred Shorthorn | |
| Bulls, 1 year and over | 2 |
| Cows | |
| 2 years and over | 25 |
| Yearlings | 19 |
| Calves | 5 |
| Steers | 19 |

VI. Animal Inventory: (Continued)

Purebred Angus

| | |
|---|---|
| Bulls, 1 year and over | 1 |
| Cows | |
| 2 years and over | 17 |
| Yearlings | 4 |
| Calves | 3 |
| Steers | 8 |

Gillette Herd:

Purebred Hereford

| | |
|---|---|
| Bulls, 1 year and over | 4 |
| Calves | 16 |
| Cows | |
| 2 years and over | 28 |
| Yearlings | 8 |
| Calves | 16 |
| Steers | 37 |

VII. Facilities:

Laramie Station:

1. Barns, sheds and corrals for breeding herd.
2. 1,200 acres pasture.

Torrington Substation:

1. Individual feeding pens and lots for group feeding.
2. Feed storage and mixing facilities.

Gillette Substation:

1. Barns, sheds, corrals and scale for breeding herd.
2. 600 acres pasture land.

VIII. Manuscripts:

Roubicek, C. B., N. W. Hilston, S. S. Wheeler, Progeny Studies with Hereford and Shorthorn Cattle. Wyoming Agricultural Experiment Station Bulletin No. 307. 1951.

Stroble, C. P., C. B. Roubicek and N. W. Hilston. Carcass Studies of Steer Progeny. Western Section American Society of Animal Production. 1951.

Haaby, E. S., N. W. Hilston and C. P. Stroble. Beef Bull Feeding Trial. Western Section American Society of Animal Production. 1952.

Becker, D. E., E. P. Margerum, C. P. Stroble, Carl Gilbert and Irene Payne. Estimation of Body Fat from Measurements In Vivo of Body Water by Use of Antipyrine. Western Section American Society of Animal Production. 1952.

## Beef Cattle Breeding Research in the Western Region

Carl B. Roubicek

The importance of the beef cattle industry in the United States, and especially in the Western Region, is the strongest argument we have for an expanding research program for beef cattle. Estimates from recent BAE figures are as follows:

| | Number of Beef Cattle (thousands) | Value of Beef Cattle (thousands $) |
|---|---|---|
| Montana | 1,988 | $ 398,020 |
| Idaho | 906 | 148,664 |
| Wyoming | 1,075 | 203,751 |
| Colorado | 1,931 | 325,605 |
| New Mexico | 1,160 | 190,269 |
| Arizona | 836 | 144,940 |
| Utah | 571 | 97,813 |
| Nevada | 572 | 105,298 |
| Washington | 707 | 119,440 |
| Oregon | 1,000 | 173,144 |
| California | 2,311 | 412,060 |
| Total - Western Region | 13,057 | 2,319,004 |
| Total - United States | 64,655 | 9,878,451 |

Thus, 21 percent of the total beef cattle in the United States are in the Western Region. Their value is 23 percent of the United States total. In addition, there are an estimated 140,000 beef cattle in the Hawaiian Islands which are also an integral part of the W-1 program. A comparison of some other livestock values in the Western Region serves to emphasize the importance of beef cattle in this area.

| | Value (thousands $) |
|---|---|
| Beef cattle | $2,319,004 |
| Dairy cows | 596,501 |
| Swine | 58,157 |
| Sheep | 444,337 |
| Poultry | 91,507 |

In general, the initial phases of the program in the Western Region have been completed. This includes the establishment of foundation herds and the obtaining of essential facilities for handling the livestock. Experimental data are now being rapidly accumulated and preliminary analyses have already been undertaken.

As shown in the State reports, many pertinent phases of beef cattle research are receiving attention. Efficiency testing of beef cattle has become a standard procedure in selection programs. The cooperation extended to the California workers in their study of the dwarf problem has provided useful information and serves as an excellent example of how cooperative action can be employed.

Various selection procedures and systems of mating are being evaluated, the results of which will be applicable to all sections of the country. The small-animal experiments now being undertaken at the Oregon Station are an important phase of this work.

The attempt to find and utilize the superior germ plasm present in various herds throughout the Western Region has met with marked success. This work has shown that superior performing individuals can be found in many herds if proper methods are used in testing.

The actual research that can be undertaken at any station is limited by number of animals, facilities, budget and personnel. There are instances, however, in which additional information could be obtained from projects now under way by more completely utilizing existing facilities and personnel. It is not feasible to enumerate all of the research phases which could be receiving additional attention. There are, however, some problems which appear to be of major importance and worthy of more consideration.

Fertility

In many areas of the west, fertility has become a major concern of beef cattle producers. Barren cows, infertile bulls, difficulty of parturition, and excessive calf losses have all contributed to the general problem. Much additional information is needed on the physiology of sterility, especially for animals which have been placed under severe environmental stress. The relation of endocrines to sterility and parturition difficulty will require much additional research. The study of calf mortality will require cooperative effort of various departments. In many instances, it may be necessary for station personnel to work directly with ranchers in studying many of the problems.

Carcass

We need to know more about carcass evaluation and the association of carcass cut-out with live-animal measurements and with various performance factors. The fact that carcass data are usually few at any one station seems to justify standardized procedures and subsequent pooling of data in order to obtain preliminary information as soon as possible.

Physiology

Urine and feces analysis, endocrine assay and other physiological and metabolic factors should be studied in relation to general performance, especially rate and efficiency of gain for individual animals. The study of the possible association of blood type with individual performance should be extended.

Qualitative Inheritance

It may be worth while to make special notes on color, pattern, pigmentation, temperment and other similar characteristics for all animals included in the breeding program. Information is still needed relative to the inheritance of these characters and in many instances they do have an economic value.

Crossbreeding

A critical study of the value of a sound crossbreeding program for the Western Region should be undertaken. There are many inquiries from commercial cattlemen in this region concerning crossbreeding; our information is not adequate.

Since many of the stations are now developing lines of beef cattle, some thought should be given to testing line crosses between stations as well as within-station line crosses. Much additional information can be obtained this way and the relative value of a line can be more accurately determined.

New Lines

In order to more thoroughly explore the genetic potentiality of beef cattle, additional lines, particularly of different breeds, should be established whenever possible. Existing lines which do not show satisfactory performance, either as individuals or in line crosses, should be discarded.

Small Animals

Additional pilot experiments using small animals would be of value to the project. Studies such as are now being undertaken at the Oregon station can give us much needed information on the inheritance of quantitative characters and permit physiological research that is virtually prohibitive with large animals.

There can be no doubt that research included in W-1 will continue to gain momentum. Increased inventories, facilities and personnel will enable the various stations to conclude many research problems that have been undertaken and will allow for the establishment of new phases of beef cattle breeding investigations.

U. S. DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH ADMINISTRATION

BUREAU OF ANIMAL INDUSTRY

and

COOPERATING WESTERN STATES



# W-1 - IMPROVEMENT OF BEEF CATTLE THROUGH THE APPLICATION OF BREEDING METHODS

Report of

Annual Meeting of Technical Committee

Corvallis, Oregon

August 4 and 5, 1952

ANNUAL MEETING
W-1 TECHNICAL COMMITTEE
Corvallis, Oregon
August 4 and 5, 1952

PROGRAM

August 4, 1952

9:00 A.M. Introductory session. (Room 300, Withycombe Hall).
1. Introduction of members and visitors.
2. Comments by O.S.C. officials.
3. Comments on tour and demonstrations. (Dr. Bogart).

9:45 A.M. Tour of O.S.C. farm and facilities.

12:00 M. Lunch (Memorial Union Tea Room).

1:00 P.M. Meats demonstration.

2:30 P.M. Committee report - Carcass Evaluation.

3:30 P.M. Committee report - Selection and Record Forms.

4:30 P.M. Committee report - Possibilities of Pooling Data.

6:00 P.M. Evening meal (Memorial Union Tea Room).

7:00 P.M. Evening program (Room 203, Withycombe Hall).
1. Program speaker--Dr. R. T. Clark.

August 5, 1952

8:00 A.M. Committee report - Pacific International Performance Evaluation.

9:00 A.M. Committee report - Feed Utilization.

10:00 A.M. Committee report - Qualitative Inheritance.

11:00 A.M. General discussion.

12:00 M. Lunch (Memorial Union Tea Room).

1:00 P.M. Business session.
1. Station progress reports.
2. Regional Coordinator's report.
3. Budget allocations.
4. Consideration of project revisions.
5. Selection of meeting place for 1953.
6. Election of officers.
7. Miscellaneous business matters.
8. Remarks by visitors.
9. National Coordinator's report.

ANNUAL MEETING
W-1 TECHNICAL COMMITTEE
Corvallis, Oregon
August 4 and 5, 1952

MINUTES

W-1 Technical Committee members present:

| | |
|---|---|
| Arizona | O. F. Pahnish |
| California | P. W. Gregory |
| Colorado | H. H. Stonaker |
| Hawaii | L. A. Henke |
| Idaho | C. F. Sierk |
| Montana | F. S. Willson |
| Nevada | J. F. Kidwell |
| New Mexico | R. M. Durham |
| Oregon | Ralph Bogart |
| Utah | J. A. Bennett |
| Washington | M. W. Galgan |
| Wyoming | N. W. Hilston |
| W-1 Regional Coordinator | C. B. Roubicek |
| Regional Administrative Adviser | M. A. Bell |
| National Coordinator | R. T. Clark |
| Bureau of Animal Industry | T. C. Byerly |
| Office of Experiment Stations | J. O. Grandstaff |
| U. S. Range Livestock Experiment Station, Miles City, Montana | J. R. Quesenberry |

Canadian visitors:

| | |
|---|---|
| University of British Columbia | A. J. Wood<br>C. M. Williams<br>Frank Whiting |

## TECHNICAL COMMITTEE MEETING

The Technical Committee met on the Oregon State College Campus, August 4, 1952. The meeting was called to order by Chairman Pahnish at 9:10 A.M. All members of the Technical Committee were present. The members and guests were introduced and the group was then welcomed by Director Besse of the Oregon Agricultural Experiment Station.

Director Besse pointed out the importance of the W-1 project as a regional enterprise and expressed to the group the confidence of the Western Directors in the progress and eventual outcome of the project.

Following the welcoming address of Director Besse the entire group inspected the animals and facilities used for beef cattle breeding investigations at the Oregon State College Campus. Dr. Bogart explained to the group the procedures that were being used in their investigations and pointed out the known characteristics of the lines assembled for the inspection.

At 1:00 P.M., the group met in Albany, Oregon, for the report and demonstration prepared by the Carcass Evaluation Committee. Mr. Margerum presented the report of the Committee. The following is a copy of the Committee report:

## REPORT OF THE CARCASS EVALUATION COMMITTEE

Annual Meeting, Technical Committee W-1
Corvallis, Oregon, August 4, 1952

To eliminate much of the detail that might be involved in this report, it is assumed by your carcass evaluation committee that workers at the Western Regional experiment stations--or other workers who might be contemplating beef cattle research involving carcass studies--are familiar with the basic cattle slaughter procedures. Should there be any questions concerning the fundamentals of slaughtering beef cattle, we wish to refer those questions to the text by Professor P. T. Ziegler of the Pennsylvania State College, titled, "The Meat We Eat," published by the Interstate Printers and Publishers, Danville, Illinois. Possibly another source of slaughter instructions and detailed procedures, which is prepared more expressly for researchers and beef carcass studies, is the 1951 Report of the Beef Carcass Evaluation Committee of the 4th Annual Reciprocal Meats Conference, compiled, published and distributed by the National Live Stock and Meat Board. Both of these references will aid those parties who do not regularly conduct beef carcass studies and will provide a refresher course for all workers.

The 1952 proceedings of the Reciprocal Meats Conference will probably not be available until early 1953, but it has been the good fortune of your carcass evaluation committee to have been present at the 1952 conference when standardized procedures for accurate and comparable methods for carcass data collection were established and agreed upon by vote of all members present. I might say at this point, that the Reciprocal Meats Conference is an annual conference held in Chicago, sponsored by the National Livestock and Meat Board, and attended by those persons engaged in meats training,

extension and research at the land grant colleges and universities of the country, as well as meats industry and U.S.D.A. meats research representatives. It is out of this conference that agreement has finally come in regard to the methods for the collection of carcass data.

Possibly our discussion here might well start with some of the pre-slaughter planning which is necessary when beef carcass data are to be collected. The assembling of the required equipment is probably basic--and aside from those basic pieces of slaughter equipment and laboratory or abattoir physical facilities which are imperative where successful collection of data is to be achieved, it is helpful to have the following:

1. A platform scale of at least a 2,000 pound capacity for the weighing of project animals.

2. Bench scales which are graduated in tenths and pounds (a capacity of 250 pounds) for obtaining weights on the kill floor and when cutting.

3. Overhead track scales to a capacity of 1,000 or 1,500 pounds.

4. A number of weighed receptacles as follows:

   a. A weighed container for collecting the blood of the animal should have a wide opening and a capacity of five gallons.

   b. Weighed pan for liver, heart, tongue, cheeks, brain, etc., which should be large enough to accommodate these parts and facilitate rapid chilling.

   c. A tray large enough to accommodate the head upon removal, and deep enough to eliminate loss of the blood from the head.

   d. Pans for other visceral parts.

   e. Weighed pan for caul fat.

   f. Weighed pan for ruffle fat.

   g. Tubs or bushel shaped containers for weighing and handling the intestines.

   h. Viscera carts should be weighed and can be used for obtaining gross viscera weights or paunch weights.

All of the above containers might well be of stainless steel which would facilitate cleaning, and would present an attractive appearance. Several extra flat trays are often found to be helpful when various parts are to be weighed, measured, and possibly photographed.

The matter of units of weight and units of measurement has been agreed upon as follows:

All weights will be taken and recorded when possible to the nearest one-tenth of a pound. This, of course, means that live weights should be secured to the nearest pound--carcass or side weights the same, and smaller portions of the animal or the carcass to the one-half and then one-tenth pound.

Wherever practicable all portions of the animal, as removed on the kill floor and in subsequent handling, should be identifiable by a tag attached to that part, or by an indelible pencil identification marking. It is impossible to exercise too much control over the identification of parts or the accurate weighing of everything that passes through the abattoir or the cutting room.

For the purpose of standardization, The Reciprocal Meats Conference has adopted the following measures:

1. Dew claws, ears, muzzle, switch. These parts should be left on the hide and may be removed after weighing.

2. Udder removal from cows. The question of whether the entire udder should be removed, or merely the "functional tissue", should be considered. More uniform results can be obtained by removing the entire udder. It is acceptable to allow the entire udder to remain on heifers, In certain instances it may even be advisable to milk out cows that are nursing so that the weight of the milk will not be lost when skinning out the udder, thus adversely influencing the empty body weight.

3. Removal of fore and hind shanks. It is suggested that the fore shanks be removed at the carpal-metacarpal junction, and hind shanks at the tarsal-metatarsal junction.

4. Tying bung, esophagus, etc. The bung and esophagus should be tied off with twine to prevent loss of contents from these parts. Tie off intestine in two places before separating it from the stomach.

## Suggested Experimental Beef Slaughter Record*

_____ Time, Date of Slaughter

**Identification**

_____ Sex

_____ Breed

_____ Live Wt. at Slaughter

_____ Blood (lbs.)

_____ Head (lbs.)

_____ Fore leg and feet (lbs.)

_____ Hind leg and feet (lbs.)

_____ Caul fat

_____ Hide

_____ Pluck

_____ Paunch (lbs.)

_____ Intestine (lbs.)

_____ Empty paunch (lbs.)

_____ Empty intestine (lbs.)

_____ Total fill

_____ Ruffle fat

Optional _____ Brain

" _____ Bladder (lbs.)

" _____ Empty Bladder

" _____ Urine (lbs.)

" _____ Height of withers

" _____ Heart girth

" _____ Depth of Chest

" _____ Circumference of middle

" _____ " rear flank

" _____ " shin bone

" _____ " round (right to left Patella)

Time taken off feed _____

Wt. End of Feed _____ lbs.

Wt. 24 hr. shrink _____ lbs.

Shrink (24 hr.) _____ lbs. _____ %

Total time off feed _____

Total shrink _____ lbs. _____ %

Price _____ Cost _____

Liver _____ lbs. _____ value

Heart _____ lbs. _____ value

Tongue _____ lbs. _____ value

Sweetbreads _____ lbs. _____ value

Cheek meat _____ lbs. _____ value

Tail _____ lbs. _____ value

**Carcass number**

Hot carcass R. _____ L. _____

Chilled carcass (24 hr.)

R. _____ L. _____

Chilled carcass (48 hr.)

R. _____ L. _____

Cooler shrink _____ lbs.

Dressing % _____ hot

Hot dress-2-1/2 % _____

Actual cold dress % _____

Carcass cost _____

*Other headings may be added when appropriate or desirable.

Following the slaughter, securing of weights and measurements in the abattoir, the subsequent shrouding and chilling of the carcass, the worker is ready to proceed with the cutting of the carcass and the collection of carcass data.

Prior to cutting the carcass, a minimum of measurement data is desirable. To collect such data from the carcass presupposes the possession of several pieces of equipment.

1. A flexible steel tape, preferably six feet long with white background and black numerals and calibrated in millimeters.

2. Large outside measuring calipers of at least 20" to 24" size.

3. A rigid transparent rule to be used in conjunction with the calipers and to make measurements on tracings.

4. A compensating polar plenimeter to be used for measuring areas in the rib eye face.

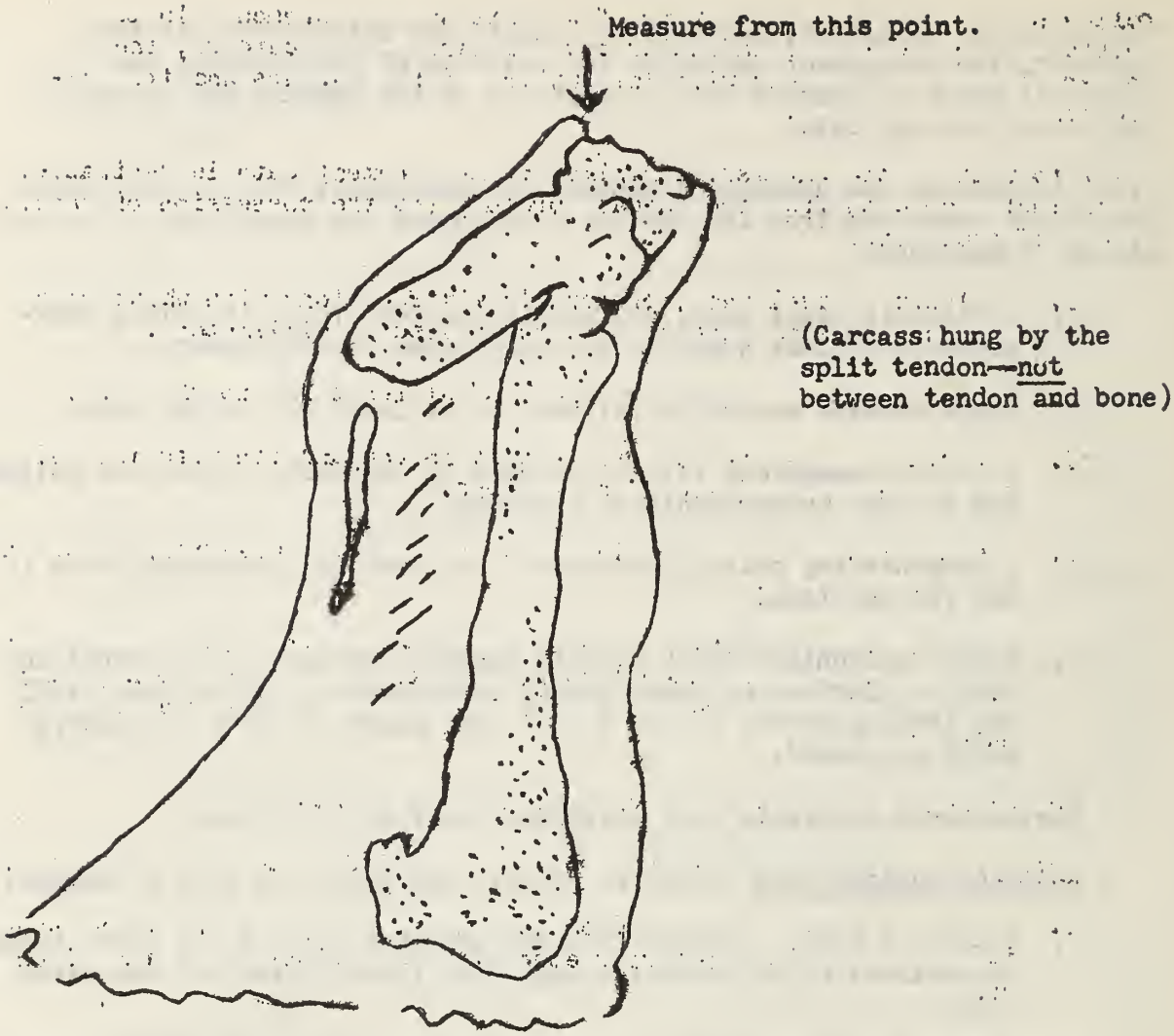
5. Those incidentals which usually expedite accuracy and convenience are: a platform or step-ladder, a protractor, shroud pins, #173 PTM tracing paper, and an 8 x 11 inch piece of heavy wax impregnated cardboard.

Measurements desirable when collecting beef carcass data.

<u>Unribbed carcass side</u> (This is usually the left side of the carcass.)

1. Length of body. Measure from the anterior edge of the first thoracic vertebra to the anterior edge (the lowest point) of the aitch bone.

2. Length of leg. Measure from the anterior edge (the lowest point) of the aitch bone to the highest point on the tarsal bones in the hock joint. This point is indicated for clarity in the following sketch:




3. Circumference of round. The circumference of the round is measured perpendicular to the length of the hind leg measurement sixty percent of the distance from the hock to the anterior edge of the aitch bone. The procedure is to establish a straight line with skewers or shroud pins between the two points used when determining the length of hind legs. Place one skewer (a) exactly sixty percent of the distance from the hock joint to the anterior edge of the aitch bone on the previously established line. From this point place a skewer (b) on the anterior side of the round along a line perpendicular to the previously established line and another (c) in the same manner on the posterior side of the round. This establishes the three necessary guides (a, b, and c). An 8 x 11 inch piece of wax impregnated cardboard may be used placing skewers (b) and (c) perpendicular to the length of leg. Measure the circumference by placing a steel tape below these three mentioned skewers and taking a reading after making sure the tape is taut and touching all three skewers.

4. Depth of body. Measure from the dorsal side of the spinal canal to the 5th thoracic vertebra on the ventral side of the sternum with the tape held parallel to the floor.

5. Length of loin. Measure from the anterior edge of the aitch bone to the middle of the 12th thoracic vertebra.

6. Width of shoulder. Measure from inside the carcass at the first thoracic vertebra to the outside of the shoulder with 20 to 24 inch outside measuring calipers. Hold the axis of the calipers in a median plane to the carcass and parallel to the floor. The sum of the measurements of the right and left side is used.

7. Width of round. Measure with the calipers from inside the carcass at the highest point of the aitch bone to the outside of the round. Hold the axis of the calipers in a median plane to the carcass and parallel to the floor. The sum of the measurements of the right and left sides is used.

Ribbed Carcass Side (Generally the right side.)

The measurements from the ribbed carcass side are designed to characterize the eye muscle (longissimus dorsi) and the adjacent external fat at the 12th rib. The measurements are customarily taken from a tracing of this portion of the carcass since it is rather difficult to take measurements directly from the rib cut. The tracing is most effective when non-absorbent paper such as PTM-173 is utilized. A soft lead pencil serves best to outline the areas of fat, lean, and bone.

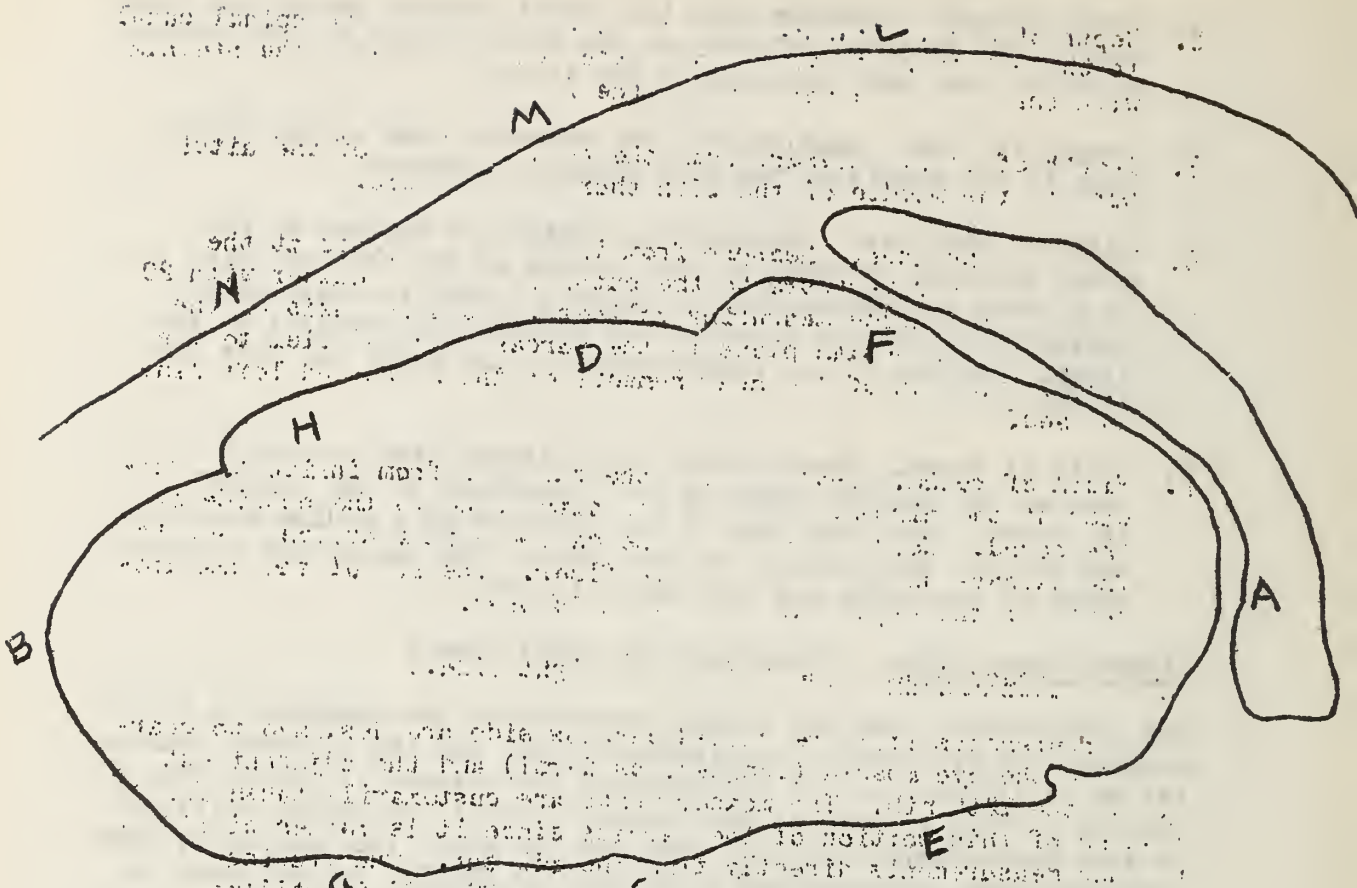
The tracing of the rib eye face at the 12th rib may be as exacting as the worker cares to make it, but the following areas and points should be located as follows:

1. Area of eye muscle. Only the longissimus dorsi proper.

2. Length of eye muscle. This is the distance along the long axis of the eye muscle (A-B).

3. Width of eye muscle. Three measurements are averaged for the width of eye muscle. The first (CD) is made perpendicular to the line used in determining the length of the eye muscle at a point one-half the distance (AB). The second (GH) is parallel to the first (CD) at a point one-fourth the distance (AB) at the ventral edge of the eye muscle. The third (EF) is parallel to the first (CD) at a point one-fourth (AB) at the dorsal edge of the eye muscle.

4. Width of fat. Measure from the outside of the fat where the surface of the fat is perpendicular to the three points on the outside of the eye muscle that were used to determine the width of eye measurement. The three measurements may be averaged or used independently.




Following the report a method of breaking a carcass into wholesale cuts from the rail was demonstrated under the direction of Mr. Oliver. After the demonstration Mr. Margerum pointed out some differences between this method and the procedure as outlined in the report. Mr. Margerum then demonstrated the accepted procedures for obtaining carcass measurements.

At the completion of the Carcass Evaluation Committee report the group returned to the Oregon State College Campus. The meeting was called to order at 3:30 P.M., by Chairman Pahnish.

The Chairman then called on Mr. Kirsch, County Agent of Gilliam County, Oregon. Mr. Kirsch described the work of the Gilliam County Beef Cattle Improvement Association in cooperative bull feeding trials. He explained briefly the scope of the work and some of the procedures used in financing and management. He stressed the importance of the cooperation he has received from the Oregon State College Staff.

Chairman Pahnish said that since Director McKee had resigned to accept a foreign assignment, Director Bell of the Montana Station had been appointed Acting Regional Adviser for W-1. He then called on Director Bell to say a few words.

Director Bell said that he was glad to act in this capacity and that the Committee and his colleagues at Montana would miss Director McKee who had been associated with the project since its beginning. He was glad to note in the introductions that every member of the Technical Committee was present. He said this was indicative that every State was interested in this project. It was emphasized at the Spring meeting of the Committee of Nine that these Technical Committees have a very definite function to perform in carrying out the general work, advisory and otherwise, of the projects set up under 9b3 funds. He complimented the W-1 Technical Committee for performing as one of the outstanding Committees of the entire group.

The Chairman then asked for the report of the Committee on Selection & Record Forms. He stated that it had seemed advisable during the year to appoint a co-chairman with Professor Willson. Dr. Durham had been appointed Chairman of the Selection Section and Professor Willson of the Record & Forms Section.

Dr. Durham's report on selection follows:

WHAT ARE WE DOING WITH SELECTION IN BEEF CATTLE
New Mexico A. and M. A.

It is rather futile to select carefully for something that is not important. A lot of the selection which has been practiced in beef cattle has thus been futile. It matters not whether an index is used, or whether tandem selection or independent culling levels are the basis, if the end point is meaningless.

Beef cattle improvement, as far as the Western range is concerned, can be divided into two phases: (1) calf production; (2) feedlot production. It is well for us to keep this division clearly in mind when we think of improvement, because each of the two phases has different ramifications. Since the most important phase of cattle production in the Western region is the calf phase, that will be dealt with first.

The statement can probably be defended that "the best cows are those which produce the most pounds of calf per section annually, and which produce for at least seven or eight years". What has been done in selection to date for this characteristic?

One has only to spend an afternoon looking for an advertising picture of a beef cow with an udder to be brought to a shocking realization. Udders must be held in such low esteem by breeders that they are penciled out. This has not always been so. A glance at Plum's "Breeds of Livestock", 1920 edition, shows pictures of famous cows with good udders. Likewise, the Gudgell and Simpson dispersal catalog shows cows with udders. One wonders, therefore, if the breeders have been selecting at all for a most important beef cattle characteristic, milk production. One generally pays attention to the things in which he is interested. Popular breeders don't appear to be much interested in this characteristic.

Since selection has been heavily biased toward conformation, and with variation and generation interval being what they are, we could not have expected much improvement. There is also a general feeling among ranchers in New Mexico area, that we must not get calves too big, or they will sell for less per pound. This feeling would tend to de-emphasize selection for heavy calf weights in ranch herds.

Some automatic selection has probably occurred. A cow that gives so little milk as to be unable to raise her calf will not be represented by that calf in the future herd. However, many purebred breeders take even that automatic selection out of the picture. With their Holsteins they can raise a calf which would and probably should have starved to death. They might answer to this that the number of calves raised on nurse cows is small, proportional to the total number of cattle. But the promising calves are the ones which are put on nurse cows, and from this group come the great show bulls which undoubtedly have a large effect, genetically, on the cattle population as a whole.

There is also some automatic selection for regular breeding. A cow that calves regularly will leave more descendants than one which is irregular. Again there are efforts to reduce this natural selection by using hormones, etc., but with probably less effectiveness on regularity than the nurse cow has on milking ability.

Pounds of calf per section may not, of necessity, mean big cows. Our data suggest that the association between cow size and calf weight is distinctly curvilinear. In other words, the large cows tend to produce large calves, but in proportion to their body weight they may be producing less pounds of calf than do small cows. This may be balanced by better reproduction in the bigger cows, but before we go all out for big body size this point should be thoroughly investigated.

Data from Colorado (Stonaker, et al 1952) and from New Mexico, indicate that feed consumption is proportional to body weight. If feed consumption is linearly associated with weight, but calf production curvilinearly associated with it, then this point certainly merits consideration in a selection program. It may be that what we should select for in cows is not necessarily great mature size, but rather good sustained milkers, fast growing but with an early cessation to growth, before they get too big. This kind of cow would also help alleviate the problem of "big" calves. If we could run more small, but highly productive cows per section, calf weight per cow might remain constant, but the total pounds of calf per section could rise markedly because we would be running more cows. This would only be true if the smaller cows produced as regularly as the larger cows. Thus can be seen the vital need for research specifically designed to answer questions about the size issue. We must make sure that we are not just selecting for size for its own sake.

It is said that we have made much progress in selection for conformation. Since most of the selection in the past in beef cattle has been for that characteristic, such would be expected. It is undoubtedly true that the visual conformation of the average beef animal has changed. The surprising fact is that there appears to be little association between calf

conformation grade and carcass grade.

Stonaker pointed out in last year's paper that the breeder who selected for high grade at weaning would get lower than average slaughter grades. Stanley and McCall (1945) at Arizona, showed that the correlation between feeder grade and carcass grade was virtually zero. Unpublished data from New Mexico indicate the same results. Thus, we proudly say, "Progress has been made in selecting for conformation", but it has been progress for visual conformation only, and not for carcass grade. Although we have changed the visual appearance of our average beef animal, probably more of this change has occurred because of grading up with sires of already acceptable visual conformation, than because of selection.

Disregarding carcass grade, which is apparently determined largely by finish, it is questionable how much of the live visual conformation changes due to selection have been reflected in important carcass conformation changes. There is no reason to think that we could increase eye muscle area, because we cannot see it in the live animal. We must rely on its association with something we can see, but that something must be some subjective measurement in the live animal. When we see a fat animal that is thick across his loin, he may be thick largely because of the fat on the outside rim of the eye muscle, not necessarily because of greater area of lean in that region. We have been inclined in the past to assume high relationships, many of which are actually either low or nonexistent. We must be careful that we are not just selecting for an aesthetic something which is not, nor ever will be, important in the practical sense.

WHAT ABOUT THE SECOND PHASE?

Most of the work to date in this phase seems centered in increasing rate of gain. How important is this? If cattle were pigs it would be necessarily important, since pigs are sold by weight and the faster a pig reaches that weight the less time he need be maintained. But cattle are not pigs and they are not sold at constant weights. There is no price differential between a prime 800-pound steer and a prize 1000-pound steer. The slower gaining steer, if he fattens readily, can be marketed in the same length of time as the faster gaining steer. So, the big advantage which is present in hogs is not a factor in beef cattle. Stonaker (1952) has found that compresta gain much slower on feed, but just as efficiently as do conventionals, when fed to a constant finish, which was rather closely comparable to a constant time. New Mexico data show that compact selections gain less on feed but the indications are that they may be slightly more efficient on a time-constant basis, and they definitely gain more in proportion to their initial weight. We must, therefore, be careful that we are not just increasing rate of gain with no increase in efficiency. The individual feeding trials aid in this matter, providing that all of the factors affecting feedlot efficiency, such as age, condition, etc., are properly accounted for. What we are trying to do in the feedlot phase is to produce the most meat possible with the fewest pounds of feed.

DISCUSSION

It is perhaps too bad that animal breeders must also delve in economics. However, this may be a good thing, as it keeps our feet on practical

ground. But, good or bad, we need to know more about the economic associations of these things we work with. It is not enough to have an inheritance catalog, which tells us how each character is inherited. We must know how important or unimportant each is. A lot of work and expense can be used in calculating the heritability of a character only to find later that it is not economically important. We need to work out the importance first and then calculate heritabilities of these important ones.

There is little doubt in this author's mind that cow productivity is the most important thing, economically, which should be improved, yet it has been given the least consideration. There is a lot more to cow productivity than just the production of one heavy calf. We have some good estimates of the repeatability of weaning calf weights. But what about regular breeding? What about longevity? We don't have to reason by inference from some other character to know that these things are economically important. For example, we calculated the amount of feed which would be required to put a cow into production, plus the amount required annually, while she is in the producing herd. The amount of feed charged to each calf is 25% more for a cow producing 5 calves in eight years, than one producing a calf every year for eight years. It is readily seen how much greater this difference is than the differences in feed lot efficiency which we find. Total pounds of beef produced per section would be markedly increased with regular breeding and increased longevity because there would be many cows producing market calves that are now producing replacements.

In terms of efficient beef production, conformation is probably the least important character we work with, yet it has been given major emphasis, and is apparently still being given major emphasis in selection programs. If we believe our data, rather than our wishes, it is obvious that conformation's real economic importance is greatly overestimated.

Selection possibilities depend on two things: (1) a large amount of variation, (2) a large amount of that variation being additively genetic, or capable of being transmitted. We know that the range of variation in the direction desired in beef calf weights limits our rate of progress toward more beef produced per section. This is due to either (1) low frequency of milking genes or (2) absence of many of the milking genes in beef cattle. In either case, selection is stymied as far as rapid progress is concerned. We should, therefore, examine experimentally the possibilities of infusing milk genes into our beef cattle. Selection can be no more effective than the genes present in the material allow. If we will take heed from those working with hogs and chickens, we will know that their progress rate has been increased many times over what it would have been, because they have utilized the variation present in various breeds by combining it. The work of Johansson and Cole, in crossing Holstein with Angus indicates that we could do the same thing with beef cattle. We know that our breeds were formed by combining diverse materials. Are we to forever sit resting on the work of Bakewell and others, who lived before anything was known about genetic variation? If beef cattle research is to make progress comparable in rate to that of other scientific work, it must be in the direction of combining the best features of all breeds of cattle.

We must also know and carefully define our aims and designs. Universal improvement in feedlot efficiency can never be attained unless we decide what it is. Is it gain per 100 pounds feed to a given weight, a given finish, or a given time? There is a lot of difference between feeding to a given weight and the other two, particularly when we work with diverse types.

We must also be very careful not to classify the efficiency of our cattle solely on feedlot test. That is only one phase of cattle efficiency, and the least important phase for the cattle on Western ranges.

Let us remember that our primary industry in these western States is calf production. Let us attend to the time-honored, but little selected-for, cow. She has been long in waiting.

Ralph M. Durham
July 15, 1952

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## An Evaluation of Conformation Scores Used in the Selection of Replacement Heifers

C. E. Safley
University of Arizona

This is a critical analysis of conformation scores as used for beef cattle research at the University of Arizona. The data consist of weaning scores on 186 Hereford calves, bulls and heifers, and scores at 18 months of age on 75 Hereford heifers. The scores were assigned by a committee of three experienced men for two consecutive years. The scoring was done on the basis of 10 for perfect.

As a basis for starting this analysis the scores of the various committeemen were correlated with each other and with the average scores. The results obtained were as follows:

Correlation Coefficients

| Scorers Compared | Heifers | Bulls | Both Sexes |
|---|---|---|---|
| 1 and 2 | .52 | .74 | .65 |
| 1 and 3 | .46 | .64 | .59 |
| 2 and 3 | .67 | .71 | .69 |
| 1 and average | .79 | .90 | .86 |
| 2 and average | .85 | .90 | .88 |
| 3 and average | .86 | .87 | .87 |

As would be expected the spurious correlations of scores by individual committeemen to the average were higher than those between any two men. The correlation coefficients between scores by individuals were near the .6 level. The coefficients of correlation for committeemen 1 and 2 and for 1 and 3 were approximately .2 higher for bulls than for heifers, while for 2 and 3 this difference was very small.

Variance analyses were used to study the relative variability between and within graders. The results were as follows:

Analysis of Variance Between Scorers

F Values

| Scorer | 1 | 2 | 3 |
|---|---|---|---|
| 2 | 15.59** | | |
| 3 | 2.19 | 5.36* | |
| Average | 3.54 | 5.22* | 0.05 |

** Sig. at .01 (required F = 6.72)
* Sig. at .05 (required F = 3.87)

Analysis of Variance Within Scorers

F Values

| Variability due to: | 1 | 2 | 3 | Average | Required F .01 | Required F .05 |
|---|---|---|---|---|---|---|
| Between years | 6.32* | 0.00 | 1.35 | 0.30 | 6.78 | 3.90 |
| Between sexes, within years | 5.98** | 1.99 | 8.57** | 6.66** | 4.72 | 3.05 |
| Between sires, within sexes, within years | 1.40 | 2.05* | 1.39 | 1.54 | 2.29 | 1.81 |

** Sig. at .01
* Sig. at .05

These analyses show that committeeman number 2 saw smaller differences between animals than did either of the other two men. It should be noted that his scores did not show a significant difference between sexes at the .05 level, although the scores of the other two men showed a significant difference at the .01 level. However, his scores did show a significant difference at the .05 level between sire groups. When his scores were compared to the other three sets of scores, there was a significant difference in each case. Committeeman number 3 saw greater differences between individuals than did either of the other two men.

Because of these differences, it was decided to see how selection differentials for weaning score and for 18-month score would be changed if the scores of each committeeman were considered singly. Using the scores of heifers actually put in the herd as replacements, on the basis of visual observation, the selection differentials were as follows:

| Scorer | Selection Differential for Score: Weaning | Selection Differential for Score: 18 Months |
|---|---|---|
| 1 | + .33 | + .29 |
| 2 | + .17 | + .24 |
| 3 | + .35 | + .47 |
| Average | + .28 | + .33 |

Since committeeman number 3 was primarily responsible for selecting these replacements, it was expected that his scores would show the highest selection differential. This, however, was also true for scores at 18 months of age, when replacements were selected on the basis of a selection index* that used the average of the scores made by the committee of three men. This is shown by the following selection differentials:

| Scorer | Selection Differential for Score | |
|---|---|---|
| | Weaning | 18 Months |
| 1 | + .29 | + .34 |
| 2 | + .14 | + .18 |
| 3 | + .25 | + .40 |
| Average | + .27 | + .30 |

Since conformation scores assigned by different individuals seem to be so highly variable, it was decided to see what would happen to selection differentials for conformation score if these scores were used in selection only as a yes or no criterion. To do this a score of 8.0 or higher was used to indicate that an individual was of acceptable beef type. Anything with a lower score was not included. Then considering all heifers with a score of 8.0 or higher, replacements were selected by an index** involving only weaning weight and 18-month weight.

*Selection index for replacement heifers $= \frac{\text{Dev. from av. weaning wt.}^{1,4}}{\text{Standard dev. of weaning wt.}} + \frac{\text{Dev. from av. Conf. Score}^{2}\text{ (wean.)}}{\text{Standard dev. of conf. score (wean.)}} + \frac{\text{Dev. from av. 18 mo. wt.}^{3,4}}{\text{Standard dev. of 18 mo. wt.}} + \frac{\text{Dev. from av. Conf. Score}^{2}\text{ (18 mo.)}}{\text{Standard dev. of conf. score (18 mo.)}}$

[1]All weaning weights corrected for age of heifer and dam.

[2]Independent culling level used to extent that animals with score of less than 8.0 at weaning time or 18 months of age were culled.

[3]All 18-month weights corrected for age.

[4]Independent culling level used to extent that animals with weaning weight or 18-month weight that were less than .9 of one standard deviation below average were culled.

**I $= \frac{\text{deviation from average weaning weight}}{\text{Standard deviation}} + \frac{\text{deviation from average 18-month weight}}{\text{Standard deviation}}$

Selection differentials for conformation scores at 18 months were calculated on this basis and found to be as follows:

| Scorer | Selection Differential for Score 18 Months |
|---|---|
| 1 | + .29 |
| 2 | + .13 |
| 3 | + .39 |
| Average | + .23 |

It can be seen by this that very little actual numerical score was lost by using this weight index as compared to an index involving score to a greater extent than just as an independent culling level.

Since the scores at this station were so variable between individual committeemen, the question arose as to how this would affect statistical calculations. To investigate this the paternal-half-rib correlation method was used to calculate heritability of weaning score. The results of these calculations showed an estimate of heritability for the single scores of number 1 and also for number 3 to be 3 times as large as for scorer number 2. Admittedly, there were not enough calves or sires represented here to show the true heritability of score, but it does show how different heritability of score might be with different men doing the scoring.

It is believed that some of the differences between scores for the same animals as designated by individual committeemen could be reduced by having a more clear-cut definition of each score than we now have.

An up-to-date set of standards portraying current market grades, with a scoring system keyed to these standards, may offer a partial solution to this problem.

Since the U.S.D.A. grades and examples of different grades are the standards to which we compare our animals, it is suggested here that these standards be brought up-to-date with pictures of more modern cattle.

## Summary

Conformation scores as used for beef cattle research at the University of Arizona were studied by using correlation coefficients, analyses of variance, selection differentials and estimates of heritability. In general, correlation coefficients for scores designated by individual committeemen were around the .6 level and the analyses of variance showed statistically significant differences between individual sets of scores. When the scores were used only to designate individual heifers as acceptable beef type or not acceptable beef type, and selection of the qualifying heifers was then made on the basis of weaning weight and 18-month weight only, selec-

tion differentials for score were no more than .07 score lower than when an index involving both weight and score was used. An estimate of heritability for weaning score was more than twice as large for the scores designated by one committeeman as for those by the other two men.

After this report Dr. Durham raised the question of establishing modern standards to illustrate market grades. Dr. Byerly questioned the importance of standards.

Dr. Durham indicated that he felt the cow had been ignored too long. A discussion followed on the correlation between small cows, medium cows and the calves produced.

The Chairman then asked Professor Willson to give the report of the Records & Forms Section. In the discussion following the report some changes and additions were suggested. After further consideration by the Committee the report as adopted by the Technical Committee was as follows:

COMMITTEE ON RECORDS AND FORMS - 1952 REPORT

It is the thought of the Records & Forms Committee that the forms gathered and distributed at the 1951 regional meeting be utilized as type examples rather than mandatory. Such records and forms can be modified and supplemented by other forms at each station to meet your own needs.

Whenever a form which is new or different from the ones already supplied by this committee proves to be particularly advantageous at any of the Western stations, the committee asks that enough of these forms be sent to the committee chairman with perhaps an explanation of their use in order that this committee can distribute a copy to each cooperating station so they may include the form in their station file on records and forms with a view to possible adoption.

If it happens that any form or forms come into use by all or nearly all of the cooperating stations, this committee feels that it may well include in its functions the arrangements through the Regional Coordinator for large scale printing of such forms to reduce costs of procurement.

One form, however, which this committee is developing for your consideration as one which we strongly suggest be adopted by all stations as standard is a group of IBM cards which will include all or most of the data which may prove adaptable to pooling. An outline of these cards is being distributed to each of you at this meeting with the idea that you will study them and offer your suggestions for improvement during the year. It is our hope that a final adoption of uniform IBM cards can be attained at the 1953 meeting.

Adopting of these cards does not imply that each station will collect data for many of the columns. The remaining columns would be left blank if not collected by the individual station.

Again, it is not implied that by adoption of this form the Western Regional organization dictates that any or all of the information placed on the cards be made available by your station for regional study. However, it

is the feeling of this committee that the information placed on such cards may often prove to be adaptable to regional study, and if and when the several stations feel that it is mutually advantageous to release it for such study, it will already be uniformly placed on cards and will not need to be regrouped for pooling.

Wherever feasible it is felt that cards should be punched at the various stations. If this is not possible, then a form should be prepared whereby the data may be copied from the station's records for punching elsewhere. In all cases there should be duplicate cards punched, one set for the Regional Coordinator's office and the other set returned to the cooperating station.

We refer to the pooling committee the important problem of suggesting who is to oversee the accumulation of these data and what restrictions are to be made on the use of pooled data.

H. H. Stonaker
Ralph Durham
O. F. Pannish for C. E. Safley
Fred S. Willson (Chairman)

SUGGESTED CODE FOR TABULATING ESSENTIAL BREEDING HERD INFORMATION ON IBM CARDS

IBM COLUMN (Female Card)

No.

1-2 Station Number

3 (1) Cow

4-7 Animal's number, the cards to be numbered chronologically consistent with the local herd number.

8-9 Line and/or cross line - Allow 99 lines.

10-13 Sire Number

14-17 Dam Number

18-19 Wright's inbreeding coefficient

20-24 Date of birth - first two columns would refer to the last two figures of the year, i.e., '50, '51, etc. The next three columns refer to the day of the year, i.e., 122nd day.

25-27 Birth weight - Actual to nearest pound.

28-30 Weaning weight - Actual to nearest pound.

31-33 Age at weaning - Number of days.

34-35 Weaning scores - In percent according A. H. Form 522.

36-38 Average daily gain during first winter feeding period - Two decimals.

39-41 Age in days at end of first winter feeding period.

42-44 Weight to nearest pound at end of first winter feeding period. Score at end of first winter feeding period (percent according to A. H. Form 522).

45-48 Seventeen-month weight - Actual to nearest pound. Off summer pasture.

49-51 Age - At 17 months in days.

52-53 Score at seventeen months - In percent according to A.H. Form 522.

54-57 Two-year-old weight - On heifers to calve as 3-year-olds.

58-60 Age - At 2 years in days.

61 Cause of removal - according to uniform code. 1. Death. 2. Chronic Bloat. 3. Injury. 4. Illness. 5. Obvious cull. 6. Abnormalities. 7. Fertility.

| IBM COLUMN No. | BULL IBM CARD |
|---|---|
| 1-2 | Station Number |
| 3 | Sex (2) Bull |
| 4-7 | Animal's number, the cards to be numbered chronologically consistent with the local herd number. |
| 8-9 | Line and/or cross line - Allow 99 lines. |
| 10-13 | Sire - Allow 99 different sires. |
| 14-17 | Dam number |
| 18-19 | Wright's inbreeding coefficient. |
| 20-24 | Date of birth - first two columns would refer to the last two figures of the year, i.e., '50, '51, etc. The next three columns refer to the day of the year, i.e., 122nd day. |
| 25-27 | Birth weight - Actual to nearest pound. |
| 28-30 | Weaning weight - Actual to nearest pound. |
| 31-33 | Age at weaning - number of days. |
| 34-35 | Weaning scores - in percent according to A. H. Form 522. |
| 36-38 | Initial age on feed - number of days. |
| 39-41 | Initial weight of feed - to nearest pound. |
| 42-43 | Condition grade (fatness) |
| 44-46 | Final age on feed - number of days. |
| 47-50 | Final weight on feed - to nearest pound. |
| 51-53 | Average daily gain. |
| 54-57 | Feed per cwt. of gain. |
| 58 | Cause of removal - 1. Death. 2. Chronic bloat. 3. Injury. 4. Illness. 5. Obvious cull. 6. Abornormalities. |
| 59-60 | Final grade - percent according to A. H. Form 522. |
| 61-63 | Height at withers - cm. |
| 64-66 | Heart girth - cm. |
| 67-68 | Round measurement - cm. |
| 69 | (1) Time constant (2) Fat constant (3) Wt. constant. |

| IBM COLUMN No. | STEER IBM CARD |
|---|---|
| 1-2 | Station number |
| 3 | (3) Steer |
| 4-7 | Animal's number, the cards to be numbered chronologically consistent with the local herd number. |
| 8-9 | Line and/or cross line - Allow 99 lines. |
| 10-13 | Sire - Allow 99 different sires. |
| 14-17 | Dam number |
| 18-19 | Wright's inbreeding coefficient. |
| 20-24 | Date of birth - first two columns would refer to the last two figures of the year; i.e., '50, '51, etc. The next three columns refer to the day of the year, i.e., 122nd day. |
| 25-27 | Birth weight - Actual to nearest pound. |
| 28-30 | Weaning weight - Actual to nearest pound. |
| 31-33 | Age at weaning - Number of days. |
| 34-35 | Weaning scores - In percent according to A. H. Form 522. |
| 36-38 | Initial age on feed - Number of days. |
| 39-41 | Initial weight on feed - To nearest pound. |
| 42-43 | Condition grade (fatness) |
| 44-46 | Final age on feed - Number of days. |
| 47-50 | Final weight on feed - To nearest pound. |
| 51-53 | Average Daily Gain |
| 54-57 | Feed per cwt. of gain |
| 58 | Cause of removal - 1. Death. 2. Chronic Bloat. 3. Injury. 4. Illness. 5. Obvious cull. 6. Abnormalities. |
| 59-61 | Length of body (aitch to anterior of 1st rib). |
| 62-63 | Round measurement (Cm.) |
| 64 | (1) Time constant or (2) fat constant (3) Wt. constant. |
| 65-68 | Slaughter wt. (live) - To the nearest pound. |

Steer Card (Continued)

| IBM COLUMN No. | |
|---|---|
| 69-70 | Carcass Grade (U. S. D. A.) |
| 71-73 | Carcass weight - (cold) to nearest pound. |
| 74-76 | Area of rib eye - according to Hankins. |
| 77-78 | Fat thickness - over rib eye (centimeters). |
| 79 | Rib eye marbling - according to _____. |

Dr. Bogart then presented the report of the committee appointed to consider the possibility of pooling data. A copy of this report follows:

REPORT OF COMMITTEE ON POOLING DATA
Ralph Bogart and Carl Sierk

This committee was appointed at the last annual meeting to study the possibilities of pooling data. Because of the change in personnel in the office of Western Regional Coordinator, it seemed advisable to delay action by the committee on pooling data until this personnel change was complete.

All Technical Committeemen were asked their views on pooling data. Some suggestions were made on the type of information that might be handled well if pooled. All but two of the members circularized answered and all were favorable to the principles of pooling data.

Some of the suggestions on the data that might be pooled are:

1. Heritability of traits of economic importance--Data are kept at many stations on birth weight, weaning weight, post-weaning gains, feed efficiency, score or grade, and measurements of live animals and carcasses.

2. Correction factors.

   Size and age of dam affecting weaning weights. Previous performance affecting results of feed testing.

   Sex.

3. Economic importance--Although each area may be different in the relative importance of production characteristics, the general estimate is important because breeding stocks do not stay on one area but are moved to others. A strain to be in demand may need to perform well in all areas as well as in the area in which it is improved. Consequently, emphasis on selection may need to be governed by a general estimate of the relative economic importance of the traits.

4. Carcass data.

   Because so few animals are slaughtered at each station, pooling would help to increase members.

5. Relation of subjective grades to objective appraisals such as measurements.

Relative to the mechanism of pooling data, it appears that two methods might be used, depending on conditions:

1. Certain States are leading out in one field but several others have data or could gather data that directly or indirectly bear on this problem. It would be logical for the leader at this station to ask for help, outlining what he needs and can use and setting forth the way he expects to handle data or material furnished him. No station would be compelled to obtain data or send data to this requesting station but all might volunteer such data. Two problems that lend themselves to this method are (a) Blood type studies, and (b) Studies on dwarfism.

2. There are many data being taken at several or all the stations that are useful to the station where they are collected for various studies but these same data might be pooled and make other studies possible. This type of pooling would require the service of the Coordinator, either to assemble and analyze the data in this type of study or to coordinate the receiving of such data and placing them in the hands of personnel that is best equipped and trained for analyzing the data.

The committee on the pooling of data requests that the Technical Committee discuss the points made in this report and determine at the Annual Meeting how to make the most use of the data that are being collected and how coordination in the collection of data might make them more useful.

We must not let the pooling of data adversely influence our progress by interfering with any station leading out in any direction it may choose or by having technical personnel at the stations "data gatherers" for some central group to analyze.

In the discussion following this report it was brought out that no States were opposed to pooling data but all States made it very clear that they did not want to be dictated to as to when and how they could collect data for pooling; also, that it was not certain if pooled data would be suitable for determining heritability estimates. However, it was something that could be found out. It was moved and carried that Record & Forms Committee and Committee on Pooling Data meet together to decide if pooling was to be attempted and to report back before end of meeting.

Meeting adjourned at 5:45 P.M., and reconvened at 7:00 P.M., at which time Dr. Clark gave an illustrated talk on his recent trip to Hawaii.

Following the talk by Dr. Clark, a meeting of the Technical Committee was held at 10:00 P.M., to consider the report of the Budget Committee. The requests for BAI funds as submitted by the Regional Coordinator for 1953-54

were tabulated by the Budget Committee. Requests for 9b(3) funds for 1952-53 were also listed.

Mr. Willson moved that 9b(3) requests for 1952-53 be resubmitted as the 1953-54 requests. Seconded and carried.

Following are tabulations presented:

| | BAI | | | 9b(3) (requested 1952-53) | |
|---|---|---|---|---|---|
| | Requested 1953-54 | Approved 1952-53 | Approved 1951-52 | No Increment | 50% Increment |
| Arizona | 7,000 | 1,800 | 1,800 | 2,500 | 4,000 |
| California | 10,000 | 2,800 | 2,800 | 3,000 | 5,000 |
| Colorado | 17,300 | 3,200 | 3,400 | 8,300 | 8,300 |
| Hawaii | 8,000 | | | | 3,000 |
| Idaho | 8,000 | | | 5,000 | 6,500 |
| Montana | 10,800 | 1,800 | 1,300 | 5,000 | 7,500 |
| Nevada | 8,400 | | 400 | 3,400 | 5,000 |
| New Mexico | 17,000 | 3,800 | 3,960 | 9,000 | 9,500 |
| Oregon | 23,000 | 3,600 | 4,800 | 8,900 | 9,600 |
| Utah | 4,800 | 2,400 | 2,400 | 7,690 | 8,000 |
| Washington | 12,000 | 2,400 | 3,000 | 6,140 | 7,100 |
| Wyoming | 11,000 | | | 3,500 | 5,000 |

Meeting adjourned at 11:00 P.M., August 4, 1952.

Chairman Pahnish called meeting to order at 8:30 A.M. Chairman asked for report dealing with Pacific International Performance Evaluation Award. Dr. Sierk reviewed the past history of the committee and pointed out that the initial request for recommendations had come from Walter Holt, Director of the Pacific International. The suggested recommendations of the Committee as presented by Dr. Sierk follow:

REPORT OF COMMITTEE ON RECOMMENDATIONS FOR ADDING RECORD OF PERFORMANCE IN MAKING SHOW AWARDS

The following suggestions have been made by members of the committee:

I. 1. Each exhibitor to place on file with the Exposition office at the time of entry a record book containing the following information:

a. Date of birth of calf.
b. Date and weight of calf at start of feeding period.
c. Feed record must cover entire feeding period, with a minimum of 180 days.
d. Feed record shall show the amount and kind of feed consumed each day.
e. Date and weight of calf at time of entry.
f. Verification of the information in the record book by the exhibitor and the 4-H Club agent or the FFA instructor.

2. A committee, appointed by the Exposition, to score the record books. The following is a suggested score card:

| | |
|---|---|
| Completeness of record | 25 points |
| Rate of gain | 25 points |
| Feed requirement | 25 points |
| Cost of gain | 10 points |
| Management | 15 points |
| | 100 points |

The committee shall have the privilege of asking questions of the exhibitor relative to the above records.

3. Live animal appraisal 50 points

4. Carcass appraisal 50 points

This proposal system of making awards would be initiated with the 4-H and FFA steers.

Live animal appraisal points would be determined by the placing of the calf in one of the respective groups, i.e., blue ribbon group, 50 points; red ribbon group, 45 points; and white ribbon group, 35 points.

Carcass appraisal points would be determined by the placing of the carcass in one of the respective grades, i.e., prime, 50 points; choice, 45 points; good, 40 points; commercial, 30 points.

II. Same as I except simplify feed record.

III. Same as I except leave out items 3 and 4 in the recommendation. Suggest equal weight be given rate of gain, economy of gain, records, and grade or score.

IV. 4-H Club and FFA Performance Test - Any steer gaining 2-1/4 pounds per day throughout his period of ownership by the exhibitor and producing a carcass grading prime will be awarded 25 percent more than the premium money in the regular show classification.

Dr. Sierk then stated that in his opinion the Technical Committee as a whole should determine the final recommendations.

In the lengthy discussion that followed, consideration was given to the kind of records 4-H or FFA members could keep for fat steers. The value of considering the final grade of the animal was also discussed. Dr. Byerly suggested a scale of points be used whereby grade and gain should be evaluated in a sliding scale. The question of using nurse cows in the production of these fat steers was then discussed in detail. Motions by Stonaker, seconded and carried as follows: Move that we include in the report of the Committee for submission to the Technical Committee the principle whereby a sliding scale of points be awarded for rate of gain and live grade (or carcass grade) and that competing cattle that have been developed on nurse cows be ineligible for this award.

Dr. Ensminger made a motion that the Technical Committee go on record as favoring the development of the proposal outlined in Stonaker's motion and that the committee on International Performance Evaluation be instructed to work out a point system. The motion was seconded and passed.

Chairman Pahnish then presented Dr. A. J. Wood of the University of British Columbia who briefly reviewed experimental work underway at that station relative to feed utilization. A complete report of this work follows:

## THE ASSESSMENT OF RATE AND EFFICIENCY OF GAIN IN BEEF CATTLE

C. M. Williams[1] and A. J. Wood[2]

The increasing interest in the assessment of quality in beef cattle by quantitative methods rather than by type or show-ring standards poses many technical problems for the research worker. It has become customary to use the rate of gain and the efficiency with which the gain is made as the two main parameters of quality. At first glance the simple measurement of change in body weight over a sufficiently long time interval should suffice to permit an expression of the rate of gain. Similarly, the exact measurement of feed consumption relative to the gain made would seem to allow an expression of the efficiency of the animal. In fact, such a method of expressing the results of feeding tests has become well established in the literature on animal production. However, there has been developed for other species of animals an extensive literature dealing with the quantitative expression of growth. An examination of this literature suggests that the efficiency-assay methods commonly used in animal production are probably in need of an extensive revision, (Huxley, 1932; Brody, 1927).

The expression of rate of gain as increase in body weight per unit of time where the time interval of necessity must be fairly long (in the case of ruminants) is fraught with a number of hazards. It implies that time, as the independent variable, has a definite and physiological meaning in terms of the metabolism of the animal. It requires little consideration to arrive at the conclusion that a 400-pound animal gaining 300 pounds in 150 days does not in fact gain at the rate of 2 pounds per day. It is metabolically unreasonable to suggest that the gain at the lighter weight is at the same rate as it would be when the animal has reached 700 pounds. It is more logical to assume that the rate of gain will tend to be a function of the body mass available for active metabolism. On this basis then it would seem desirable to assess growth propensities against the base of the body weight of the animal at the time of the measurement of the growth rate. Practically, such a method is impossible, particularly

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with animals of the type with which we are concerned. Brody (1945) has suggested the use of a simple procedure of the calculus to integrate this series of infinitely small gains relative to the weight of the animal at the time these gains are made. Expressed in symbolic form:

$$\frac{\frac{dW}{dt}}{W} = K$$

Where K is the instantaneous relative growth rate.

or

$$\frac{dW}{dt} = K W$$

$$\int_A^W \frac{dW}{W} = K \int_0^t dt$$

$$\text{LnW} = \text{LnA} + Kt$$

Where LnW is the natural logarithm of body weight at time t and LnA is the natural logarithm of W at t = 0.

The expression when rearranged can be expressed as follows:

$$K = \frac{2.303 \log. W_2 - 2.303 \log. W_1}{t_2 - t_1}$$

This expression implies that an arithlog plot of time against body weight should yield a linear relationship if the animal grows at a constant rate. The slope of this line or the constant K of the equation has the definite meaning of relative gain per unit of time at any selected body weight (or percentage rate when multiplied by 100). To illustrate the point, Figure 1 shows an arithlog plot from some recent results obtained in the course of a bull-testing project. The weights of the animal were recorded weekly. From the slope of this line it is apparent that the animal tended to grow at the constant rate of 0.38% per day over the experimental period of 154 days. This constancy of rate indicates that at 500 pounds the gain per day was 1.9 pounds (0.0038 x 500) while at 700 pounds the gain per day was 2.66 (0.0038 x 700) pounds. During the experimental period of 154 days this animal gained 327 pounds. By the conventional method of expression one would compute that he had gained at the rate of 2.12 pounds per day. This gain is in fact the mean gain at the midpoint of the curve shown in Figure 1. On this basis one might argue that little has been achieved by computing the growth rate on the basis of the instantaneous relative growth rate expression. Unfortunately, however, one finds that animals for some physiological reason do not maintain the same constant percentage rate throughout their growth period. Figure II shows a similar plot for a second bull (Bull No. 5) in the same experiment. Here it may be noted that the animal grew at a rate of 0.46 percent to a body weight of approx-

imately 650 pounds and then proceeded to grow at 0.22 percent per day--that is, at less than half its former rate. This means that this bull was gaining at the rate of 2.66 pounds per day at a body weight of 575 pounds and at a rate of 1.54 pounds at a body weight of 675 pounds. At first sight such a result is somewhat disturbing from the standpoint of practical experimentation. From the fundamental aspect it suggests a marked physiological change in the metabolic or growth pattern of the animal at a body weight of approximately 650 pounds. Such changes or points of inflection in the growth curve of animals have long been known and some workers have related these points to definite physiological periods in the animal's development. For example, in the case of a growth plot like that of Bull No. 5 (Figure 2) it has been suggested that the change in the slope of the curve represents the onset of puberty, (Brody, 1945). Such a suggestion is given support from the fact that many of the secondary sexual characteristics of this bull were becoming apparent at about this time. Table I presents a summary of results from a recent experiment with 10 purebred Hereford bulls computed by the conventional procedure whereas Table II and Table III present the actual gains at body weights of 575 and 675 pounds of the same animals calculated from the arithlog regression lines of weight against time.

It is evident that an entirely different rate-assessment value is obtained when the animals are compared at the same weights as shown in Table II and III as compared with conventional rate figures given in Table I. The expression of rate of gain for the comparison of animals differing appreciably in initial weight in a growth test cannot be carried out with accuracy using the conventional procedure. Since the animal tends to grow at a constant percentage rate then its daily rate of gain is a function of the body weight at the time the measurement is made. It would seem that legitimate comparisons can be made only when the animals are at equal weight.

From the standpoint of the research worker the expression of growth in terms of the instantaneous relative growth rate constant has a number of advantages. Since it has been shown that the characteristic breaks in the arithlog growth plot occur in beef cattle as they do in other species, it is possible that these breaks may be utilized to determine the periods of growth which produce maximum product gain per unit of feed energy used. At the risk of criticism for the extrapolation of the meagre data at present available, it may be worthwhile to expose some of the thoughts that have passed through our minds on this subject.

The degree of change that takes place in the growth rate is of an order that suggests that a major neuroendocrine shift occurs producing its effect on the metabolic activity of the animal. If it is to be assumed that this "pubertal break" in the growth curve represents that point at which the rate of deposition of fat becomes dominant over the rate of synthesis of muscular tissue (McMeekan, 1941), then one would expect a decrease in the efficiency of gain. In the case such as that shown in Figure I, the delayed appearance of the "pubertal break" until the animal reaches 700 or 800 pounds means that its external appearance will not be favorable by conventional-type standards. Conversely, the earlier the "pubertal break" the more acceptable will the animal be from the type standpoint and the less acceptable it will be from the rate and efficiency standpoint.

The assessment of efficiency of gain presents as many problems as the adequate expression of growth rate since the two must unquestionably be linked. The definition of efficiency as such is not easy. In the thermodynamic sense efficiency is the ratio of energy stored in the product to the energy required for the production of the product. In the practical sense it represents the ratio of marketable product obtained per unit of feed consumed. It is evident that the gain in body weight obtained per unit of feed energy consumed will be determined in large measure by the nature or composition of the gain made by the animal. Undoubtedly, such factors as digestibility, specific dynamic action and the biological quality of the protein available for absorption will affect the rate and efficiency of gain but it appears more logical to assume that the major factor must be the nature of the gain made by the animal. The gain of one pound of body weight in the form of muscle or protein indicates the storage of about 450 Calories, whereas a gain of one pound of body fat represents the storage of approximately 3900 Calories or eight times as much as that for muscle. Although compositions of gain of the animals at the age and weight normally encountered in testing programmes do not consist entirely of either muscle or fat, there can be no question that a slight predisposition in the direction of either material will have a marked effect on the efficiency and rate of gain.

This point may be illustrated further by the following example using composition of gain figures for a 700-pound animal of the order reported by Haecker (1922) and Callow (1947).

Case I - a 700-pound animal gaining in such a way that 10 percent of the weight gain is in the form of fat and 16.5 percent of the gain is in the form of protein: each pound of body weight gain will represent the storage of approximately 860 Calories.

Case II - a 700-pound animal gaining in such a way that 20 percent of the weight gain is in the form of fat and 14 percent of the gain is in the form of protein: each pound of body weight gain will represent the storage of approximately 1200 Calories.

This means that for each 1000 Calories of net energy consumed above maintenance, the animal in Case I will be able to gain 1.18 pounds per day, while the animal in Case II will only gain 0.83 pounds per day. As shown above, in the net energy sense, Case I will be utilizing 850 Calories per pound of gain while Case II will be using 1250 Calories for the same gain. Translated into the usual T.D.N. terms, Case I will be using 340 pounds of T.D.N. per 100 pounds of gain when consuming 2000 net Calories above maintenance and gaining 2.36 pounds per day while Case II will be using 483 pounds T.D.N. per 100 pounds of gain when gaining 1.66 pounds per day, assuming that the maintenance metabolism is the same in each case. This calculation is in close agreement with the type of result reported from various bull-testing projects and obtained in our own recent experiments. It is obvious that additional experimental work is necessary on the nature of the gain made by animals at various points of the growth curve. Additional support is given to the above calculations by the results reported by Morris et al (1946) for the laboratory rat.

If the considerations outlined above can be confirmed by experimental proof, it would seem likely that the assessment of the merit of bulls by present testing methods is likely to be open to appreciable error. In view of this it may be desirable that Canadian effort be directed, at least for the next few years, towards the evolution of more satisfactory procedures for routine testing.

In conclusion, the following outline of a satisfactory assessment procedure is offered for discussion. The animals to be tested should be of equal weight or at least start on test at a uniform weight of 350 pounds for females and 450 pounds for males. The starting weight for males should be lower than this but practical considerations with reference to weaning weight probably preclude entering males at a lower weight. The ration to be fed should be formulated to meet the nutritive requirements of cattle of this weight to the best of present knowledge. The feed intake should be based on the most acceptable feeding standard available and should be at a daily level predetermined on the basis of the animal's weight at the time. The animals should be weighed once weekly or oftener at a carefully standardized time relative to the feeding period.

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Table I SUMMARY OF WEIGHT GAINS AND FEED CONSUMPTION OF TEN PUREBRED HEREFORD BULLS

| Bull No. | Age in Days 2/12/51 | Weight in lbs. 2/12/51 | Weight in lbs. 4/5/52 | Gain in 154 Days | Average Daily Gain | Efficiency per 100 lb. Gain | |
|---|---|---|---|---|---|---|---|
| | | | | | | Hay | Conc. |
| 1 | 248 | 551 | 844 | 293 | 1.9 | 342 | 367 |
| 2 | 308 | 597 | 913 | 316 | 2.1 | 372 | 330 |
| 3 | 189 | 406 | 733 | 327 | 2.1 | 188 | 331 |
| 4 | 201 | 473 | 833 | 360 | 2.3 | 233 | 302 |
| 5 | 231 | 537 | 830 | 293 | 1.9 | 338 | 367 |
| 6 | 194 | 432 | 733 | 301 | 2.0 | 216 | 363 |
| 7 | 242 | 449 | 742 | 293 | 1.9 | 231 | 376 |
| 8 | 247 | 463 | 799 | 336 | 2.2 | 231 | 325 |
| 9 | 230 | 546 | 854 | 308 | 2.0 | 326 | 350 |
| 10 | 209 | 539 | 852 | 313 | 2.0 | 313 | 342 |

Table II GAIN AND FEED EFFICIENCY OF BULLS AT 575 POUNDS BODY WEIGHT

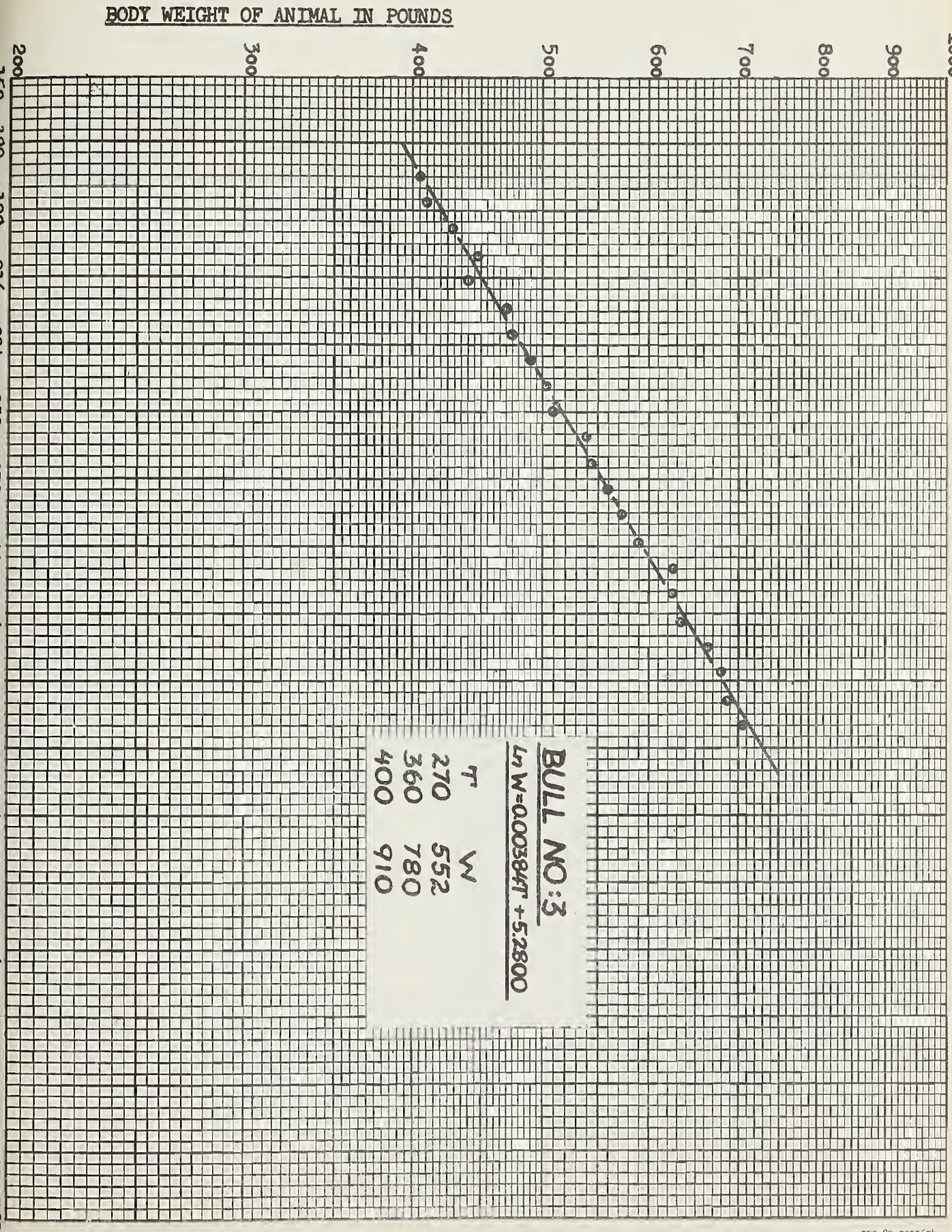
| Bull No. | Body Weight | Gain /Day | Feed/Day Hay | Feed/Day Conc. | Feed/lb. Gain Hay | Feed/lb. Gain Conc. |
|---|---|---|---|---|---|---|
| 1 | 575 | 1.59 | 4 | 7.5 | 2.51 | 4.72 |
| 2 | 575 | 1.59 | 4 | 7.5 | 2.51 | 4.72 |
| 3 | 575 | 2.21 | 4 | 7.5 | 1.81 | 2.40 |
| 4 | 575 | 2.12 | 4 | 7.5 | 1.89 | 3.54 |
| 5 | 575 | 2.66 | 4 | 7.5 | 1.51 | 2.82 |
| 6 | 575 | 1.98 | 4 | 7.5 | 2.02 | 3.78 |
| 7 | 575 | 1.87 | 4 | 7.5 | 2.14 | 4.01 |
| 8 | 575 | 2.04 | 4 | 7.5 | 1.96 | 3.68 |
| 9 | 575 | 1.67 | 4 | 7.5 | 2.39 | 4.49 |
| 10 | 575 | 1.71 | 4 | 7.5 | 2.34 | 4.39 |

Table III GAIN AND FEED EFFICIENCY OF BULLS AT 675 POUNDS BODY WEIGHT

| Bull No. | Body Weight | Gain /Day | Feed/Day Hay | Feed/Day Conc. | Feed/lb. Gain Hay | Feed/lb. Gain Conc. |
|---|---|---|---|---|---|---|
| 1 | 675 | 1.86 | 6 | 7 | 3.23 | 3.76 |
| 2 | 675 | 1.86 | 6 | 7 | 3.23 | 3.76 |
| 3 | 675 | 2.60 | 6 | 7 | 2.31 | 2.69 |
| 4 | 675 | 2.48 | 6 | 7 | 2.42 | 2.82 |
| 5 | 675 | 1.54 | 6 | 7 | 3.90 | 4.54 |
| 6 | 675 | 2.32 | 6 | 7 | 2.59 | 3.02 |
| 7 | 675 | 2.19 | 6 | 7 | 2.74 | 3.19 |
| 8 | 675 | 2.39 | 6 | 7 | 2.51 | 2.93 |
| 9 | 675 | 1.96 | 6 | 7 | 3.06 | 3.57 |
| 10 | 675 | 2.01 | 6 | 7 | 2.99 | 3.48 |

[illegible]

[illegible]




GPO 82-9000694

TABLE I

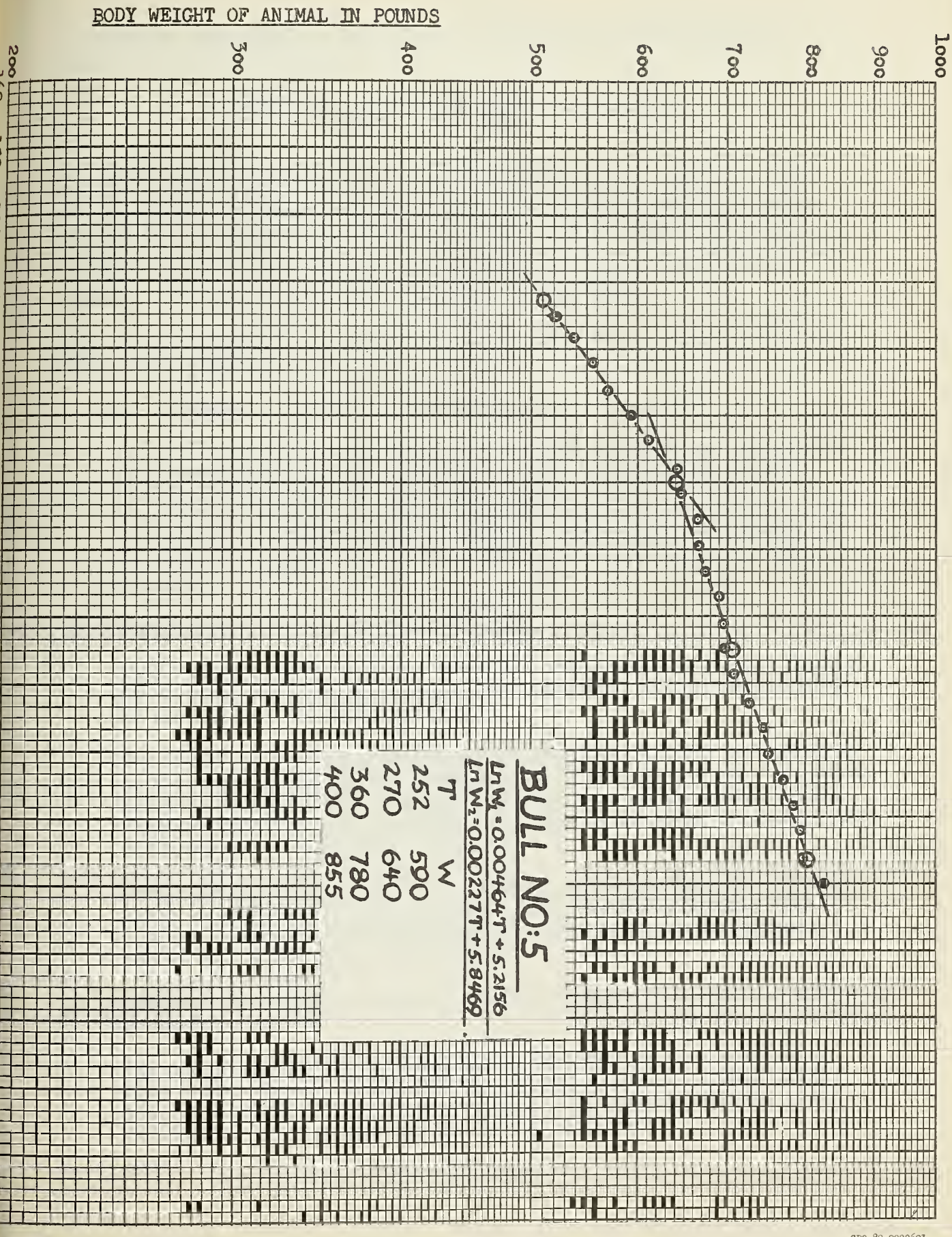



TABLE II

GPO 82-9000693

Mr. Bennett presented the report of the Feed Utilization Committee. A copy of this report follows:

REPORT OF COMMITTEE ON FEED UTILIZATION
James A. Bennett, T. B. Keith, M. W. Galgan

The committee recognizes that accurate measures of efficiency of feed utilization are very difficult to obtain. Most of the stations within the region have expressed the opinion that testing procedures at present are not as accurate as could be desired. The committee suggests that full attention be given to standardization of tests at each station so that animals can be accurately compared. Standardization of tests between stations is not highly important at this time.

Some of the important sources of variation other than hereditary differences are as follows:

1. Age or weight at which the performance test is started.

   Age and weight are normally closely related and both are associated with efficiency of feed utilization. Useful correction factors have been developed for correcting weaning weights on calves of varying ages but adjustments evidently should be made for the performance test period following weaning. Statistical adjustment by the least squares method offers possibilities and should be fully explored.

2. Environment of calves previous to test.

   This includes both the pre-weaning and post-weaning periods. During pre-weaning the type of pasture, creep-feeding, and milking ability of the dam are contributing factors.

   The length of the conditioning period following weaning and previous to the start of the actual feeding test as well as the type of ration has been thought to be important. Recent work at the Idaho Station suggests that the type of ration in regard to roughage-to-concentrate ratio may be of only slight importance.

   When suitable procedures for determining and accounting for differences in condition of animals much of the variation arising from lack of uniformity of environment prior to the start of the test period may be adjusted statistically.

3. Difference in degree of fatness at the start and finish of the feeding test.

   The use of antipyrine for determining differences in condition in live cattle appears to be the most suitable accurate method available at present. It is suggested that full consideration be given to adopting this as part of the testing procedure.

4. Time of weighing.

The matter of fill at the beginning and end of the test period is important and needs further study. Where animals are fed in groups, error due to fill tends to compensate and disappear. Where the gains and efficiency of the individual are being measured, there can be an error as great as one-third of the gain of an animal.

Under most conditions a weight taken in the morning before feeding and after the animals have been off water for 12 hours appears to be more reliable than weights taken at any other time of the day if animals are fed and watered.

5. Frequency of weighing.

There are many advantages in taking several weights during the test period. Statistical adjustments can then often be made to take care of some of the variations in gains. If adjustments are to be made for differences in size of animals a minimum of eight weights will be needed under most conditions.

6. Rations and feeding methods.

Knowledge of the influence of rations and methods of feeding is not adequate at present. More detailed information is needed, particularly on the following:

(a) Ratio of concentrates to roughage.
(b) Pelleting and non-pelleting.
(c) Self-feeding or hand-feeding.
(d) Correlation between performance of the animal on test rations, and the actual ability to utilize range pastures and harvested roughages that the commercial cattlemen will normally have.

7. Length of feeding period.

The feeding period should be sufficiently long to properly test the ability of the animal to consume feed. When differences in percentage body fat can be accurately measured, the length of the test period may, possibly, be reduced.

8. Blood tests.

The value of blood tests as indicators of the ability to utilize feed should be fully explored.

Mr. Bennett then pointed out that the remarks of Dr. Wood should be given serious consideration by the group. As an example, some stations are testing bulls through a constant weight period; others are testing on an age constant basis. Some stations have tried both tests at the same time, and the comparison of efficiency is not very close. He also stated that preliminary results at Wyoming and Utah with antipyrene appears to have possibilities, especially as technique is improved.

Mr. Bennett also discussed methods of weighing test animals and recommended that animals on efficiency test should be weighed every week or every other week; at least 8 weights should be taken during a feeding trial in order to

compare individual animals. He also stated that he thought it important to compare performance of animals on efficiency test and performance on the range.

Dr. Bogart raised the question of using pelleted feed. Various opinions and suggestions were expressed by the group. Work at Utah indicates that a very satisfactory pellet, composed of 2 parts concentrate to 1 part roughage, may be easily made. A feeding trial at Yuma County, Colorado, in which pellets were used, proved to be very satisfactory. New Mexico has been successful in pelleting a poor grade of chopped alfalfa alone. It was also pointed out that a horizontal mixer is more successful than an upright in mixing concentrate and chopped roughage.

Chairman Pahnish then asked Dr. Gregory to present the report on qualitative inheritance. Dr. Gregory reviewed the current status of the dwarf investigations in beef cattle. He had a number of illustrations on the board and showed a series of slides on profiles of heterozygous and homozygous normal bulls. He then explained the development of the head profile technique for diagnosis and the classification system used. He pointed out the accuracy of the classification system based on results obtained by predicting genotype of bulls based on head classification alone and then comparing this prediction with breeding results. With a total of 56 bulls predicted and proven, only 1 was found to be in error.

At the conclusion of the report Dr. Roubicek pointed out that field experience indicated that the problem of having profilometer service available to ranchers had reached a critical stage. He stated that indications were that there would soon be a terrific demand for profilometer service by the breeders which could not be met without a more adequate plan. Dr. Roubicek also stated that in many herds the rancher would need help in working out a subsequent breeding operation after his bulls have been classified. The importance of using people thoroughly trained in using the profilometer was stressed by Dr. Roubicek. Since California has pioneered in this work and has well-trained personnel available, it would appear logical to send all profiles to that station for classification.

Dr. Gregory said that he was going ahead working with breeders and was giving breeders all the service they wanted in the identification of herd bulls. Extension specialists are cooperating and are going to have profilometers with them at all times. He stressed the fact that he had no difficulty in herds where there was a high percentage of dwarfism, but he found it difficult to convince a rancher he had carriers if the herd had only one or two cases or no dwarfs.

Dr. Durham said he represented the feeling of the New Mexico station and of Mr. Knox when he questioned whether there might be some danger in this program. He felt that the dwarf gene is still somewhat localized in big name herds. He feared that these breeders would be prone to sell their heterozygous bulls to the commercial operator at low prices and thus disseminate the gene. He said if a program to classify herd bulls were attempted, there should be a common brand used to mark the carriers when the animals are classified.

Dr. Gregory emphasized the importance of men being well trained and of having techniques standardized. Dr. Gregory said he thought it should be up to each station as to how they were going to operate, and he would be glad to work with and train any men the stations wish to send to California. He also agreed to interpret all profiles sent to him as long as they are good profiles.

After further discussion regarding procedures that could be used in training personnel or handling the service, Dr. Gregory made a motion that we let the thing ride and let each station meet the situation as it comes. Seconded and carried.

Chairman Pahnish asked for the recommendation of the Committee on pooling data. Dr. Bogart moved that we proceed on pooling data by studying: (1) the problems that need solving in which data pooling would be advisable, and (2) the data that are available; that the Regional Coordinator be the one to channel requests through for such cooperation and that a committee be appointed to advise with the Coordinator relative to policy and other matters concerned with pooling data. Seconded and carried.

The Chairman stated that the station progress reports had been circulated to all members of the Technical Committee. He suggested that, with approval of the group, further discussion be limited to additions the representative of each station might care to make and to answers to questions raised by the group.

Wyoming - Dr. Hilston indicated they were going to continue antipyrine work and also send a man to California with Dr. Stormont on blood typing work.

Washington - Mr. Galgan said that they were continuing the project as outlined. He indicated that they had 20 commercial breeders and 45 purebred breeders over the State actively cooperating in their project, and they had definitely committed themselves to continue the work in the fall.

Utah - Mr. Bennett indicated that he would like to point out an error in the Utah report--that is, that the 10b and 9b funds are in reverse order. He said they were also going to do some more work on antipyrene. He thought it was a promising method that needs more work. He said they now had quite a few breeders who were interested in testing bulls but that he did not know what the best method of handling requests was and that he would be interested in having that discussed later on.

Oregon - Dr. Bogart said that the Oregon station was going heavy on metabolic studies. He said they had two technical bulletins and one other bulletin in preparation; they had presented one paper in California and had in mind presenting one at the Chicago meeting.

Nevada - Dr. Kidwell indicated that there would be some personnel changes so far as the Nevada project was concerned. They are adding a physiologist and a nutritionist, both Ph.D.'s, who will join the project shortly. He stated that the project would be revised during the coming year, but he could not now indicate the extent of the revision. He said it was originally set up with the idea that it would be revised during 1952 and 1953 on basis of information gained to that point. He indicated that there

were several things they were interested in developing this coming year--one was real feed utilization. One thing they are concerned about is how to define efficiency at a work level. They plan a combination of antipyrine and nitrogen balance data.

New Mexico - Dr. Durham said it would be 2 or 3 years before they could get a good picture of the results of their breeding experiments with large and compact bulls and cows. He said they were about to start analysis of data obtained on a large herd of Angus that had been hand-mated or tagged at birth, so have considerable working data, and feel they can begin to scratch the surface on sire difference as far as cow productivity is concerned.

Montana - Prof. Willson called attention to the information made available to buyers at their indexed bull sales. This material described tests the bulls had been on and gave the performance records of groups and of individuals. He said response had shown people evidently were paying some attention to performance tests. They will continue their work pretty much as it had been except that they were dropping bull index work for private breeders. He indicated that some interest had been shown in setting up regional testing grounds similar to Gilliam County test here. They hope breeders will take up testing themselves. He said they had set aside a herd of Herefords, not related to their regular herd, to be used by the Hereford Breeders Association who had promised to provide them with good show-type bulls for this herd. He felt this would give them good material for classroom work. Mr. Quesenberry (Miles City) said that they had found in their experiments one line of cattle that combines much better than others, but that they are not very high in fertility.

Idaho - Dr. Sierk indicated all of their beef cattle would be included in their project. He said they had purchased some Herefords with Sears & Roebuck funds, and that one of the bull offspring of one of the cows that was purchased gave them a very fine polled bull. This bull was the outstanding one they had on feed. He has been out in a cooperator's herd this summer on commercial cattle and on registered polled cattle. Dr. Sierk stated they would like to establish a polled line. He said they were in need of cooperating with breeders from the standpoint of test cattle; they do not have a test herd of any kind or facilities for it. In line with the addition of more cattle to the project, this very definitely will call for a revision of the Idaho project, and he hoped soon they would be able to circulate the revised project outline to the Technical Committee and have it ready for final adoption at the next Technical Committee meeting.

Hawaii - Dr. Henke said the Hawaii project had just been initiated and that they felt most fortunate in having had the services of Dr. Clark to work with them for a period of 4 months. He explained that their project was quite different from most of those in the States as it was entirely cooperative with ranchers. They cooperate with five ranchers, all of whom have very sizeable herds--the largest is 35,000 Herefords. All have at least 5,000 Herefords in their herds. They have established a number of single-sire 20-cow herds. He stated that almost all their feeding was on grassland as they did not have the commercial feeds. They had a memorandum of understanding signed by ranchers and by the station which clearly indicates what the responsibility of each party is in each case--not a haphazard thing.

Colorado - Dr. Stonaker reported that the Colorado station had been busy trying to get into shape some of the data already accumulated. They had been selling their surplus cattle at public auction the last few years and had encouraged last year the feeding of bulls from cooperating ranches, in addition to their own. They fed 80 last year which was a 50 percent increase from the year before, and are trying to work up to 120 this year.

California - Dr. Gregory reported they had 2 projects, and the reports submitted pretty well covered their work. He mentioned some of their publications that are immediately in the offing. They have one bulletin soon to come out on heterozygous expression of the dwarf gene in mature bulls and recognition of heterozygous and homozygous normals. They expected soon to have a report out on a collaborating project which they had with Washington State and Wyoming, and perhaps some other stations which might come in on it. He indicated another report that might cover a survey of the dwarf problem on beef cattle and it will embrace all the genes that they have encountered that are involved in dwarfism. Another paper he hopes to get to is an estimate of dwarf gene frequency in bulls as they find them in commercial and purebred herds.

Arizona - Mr. Pahnish indicated that their one four-sire herd is now two individual herds. He stated the ownership and procedure had not changed, except that they have two herds of two sire groups each. He felt that this would help them from the range management standpoint.

The Chairman said that concluded project reports. He stated that he does have one project revision and that each member of the committee had received a copy in the early part of December. This was a revision of the New Mexico project for the purpose of establishing lines of cattle free from the dwarf gene. Dr. Durham moved that revised project be accepted. Seconded by Dr. Gregory. Motion carried.

The Chairman then called on the Regional Coordinator to say a few words. The report of Dr. Roubicek follows:

The initial phases of W-1 data are being analyzed at practically all stations and results are now forthcoming at an increasingly rapid rate. A total of 58 manuscripts has been published from this project, 28 of which came out during the past year. A brief review of the status of W-1 as of July 1, 1952, shows the following statistics:

11 Western States and Hawaii actively cooperating.
65 Technical workers.
5,158 head of cattle.
119 lines (including 8 test herds)
69,428 acres of land.

State contributions to the project include:

| | |
|---|---|
| Facilities | $2,074,867 |
| Livestock | 1,925,275 |
| Land | 1,068,335 |
| Total | $5,068,477 |

In addition, new laboratory facilities for meats, physiology and genetic investigations have been established at several stations.

On the basis of the record to date there can be no doubt that the project will continue to expand. In the very near future some stations will have to critically re-evaluate their project in order to obtain maximum use of personnel and facilities now available.

The Chairman then indicated that since the meeting last evening the Budget Committee had seen fit to reconsider the budget, particularly as it pertains to 9b(3) funds and asked Dr. Sierk to present their findings. Mr. Willson moved that they reopen the budget report for further discussion. Seconded and carried.

Proposed changes in 9b(3) recommendations were discussed. The following budget was adopted by the Technical Committee:

Proposed Budget 9b(3)
1953-1954

| | No Increase | 50% Increase |
|---|---|---|
| Arizona | $2,500 | $3,500 |
| California | 4,600 | 5,000 |
| Colorado | 8,000 | 8,900 |
| Hawaii | 1,000 | 3,000 |
| Idaho | 5,000 | 7,000 |
| Montana | 5,800 | 7,000 |
| Nevada | 3,900 | 7,000 |
| New Mexico | 8,000 | 8,900 |
| Oregon | 8,000 | 8,900 |
| Utah | 5,500 | 7,000 |
| Washington | 5,000 | 7,000 |
| Wyoming | 4,700 | 7,000 |
| Planning and Coordination | 2,000 | 1,800 |

Bennett moved that in the future the Budget Committee be instructed to bring in recommendations concerning all Federal funds, 9b(1), 9b(2), 9b(3) and BAI. Motion seconded and carried.

The Chairman asked what the wishes of the group were in regard to special committees. Dr. Durham suggested a committee to study means of evaluating cow productivity. Dr. Sierk moved that the Regional Coordinator and Technical Committee Chairman for the coming year review the situation and appoint such committees as they feel are desirable. Seconded and carried.

Dr. Stonaker then gave the report of the Resolutions Committee. (Members besides Dr. Stonaker were Dr. Sierk and Dr. Ensminger).

1. Be it resolved that the W-1 Technical Committee express its gratitude to the representatives of the Oregon Station for their courtesies and hospitality.

2. Be it resolved, That the W-1 Technical Committee express its appreciation to Clyde McKee, former Director of the Montana Experiment Station and W-1 Regional Administrative Adviser, for his excellent leadership, counsel, and advice during the initiation and development of the W-1 project.

3. Be it resolved, That the Beef Cattle Research activities of the U. S. Range Livestock Experiment Station be included in the W-1 Regional Beef Cattle Breeding Project and that the Superintendent or his appointed representative from the staff of the U. S. Range Livestock Experiment Station be included on the W-1 Technical Committee.

The resolutions were adopted. The question of establishing the location and date for the 1953 Technical Committee meeting was placed before the group. Invitations were issued by the representatives of the Wyoming and Nevada stations. Mr. Willson moved that the meeting time and place next year be decided by the Executive Committee. The motion was seconded and carried.

Dr. Sierk moved that the Chairmanship of the Technical Committee continue to rotate alphabetically by stations and that Dr. Gregory be Chairman for the coming year. This motion was seconded and carried.

The Chairman then called upon Dr. Byerly to make a few remarks.

Dr. Byerly said he had been interested in a publication on the future of agriculture called "Agriculture's Capacity to Produce." He quoted some statistics from this publication on increase in numbers of cows in different regions. He recalled that they had discussed at lunch time the cost of beef production, and that he thought this was a very important topic. He did not know whether discussion now or in the future would change the situation very much because this is a long-term task and one that is very important.

He said they are permitted to work for two things--one is a substantial increase in funds for beef cattle breeding research which will include work of federal cooperative stations and work in these regions, all of which is now coordinated programwise under Dr. Clark's leadership. The other increase is one on forage utilization which would mean a gain for beef cattle of about 50 percent. This is for forage studies in digestibility in ruminants. He was hopeful that they would get some increases and stated that he needed support from the stations in the way of statements of what was needed and how it would be used. He said it would help if they would send a preliminary draft to Carl Roubicek so that he might have that before September 15th. He asked for their suggestions and guidance as to what in their opinions would be the most effective to say. He said if he didn't make a good story it would be their loss. One of the reasons why he will support increases for beef cattle breeding is because of the relatively high income from beef cattle as compared to other classes of livestock.

The Chairman asked Dr. Grandstaff from Office of Experiment Stations to say a few words. Dr. Grandstaff said it had been a real pleasure being present and that the Office of Experiment Stations has a real interest

in this project. He is now Animal Husbandman in that office and so would undoubtedly be seeing more of the Technical Committee members from time to time. He indicated that it would help him if each of the members would furnish him with copies of their publications to date so that he might bring himself up to date on what has been accomplished. He said when he was in Stillwater recently that there was a comment which he thought especially pertinent, "When you are conducting research with public funds there is a definite responsibility to put those results out as promptly as possible where they can be used." He was sure they were well aware of that as evidenced by their annual reports. He also emphasized the importance of fundamental research and the value of cooperative effort in many research problems.

The Chairman asked Dr. Clark if he had any comments.

Dr. Clark said he had greatly appreciated returning to this campus. He said the progress here in physical plant and facilities is indicative of what is happening in animal science all over the country; it is encouraging to see that happening. He thought that in the last 5 or 6 months he had also been made quite aware of the definite interest that industry now has in what we are doing. Interest is increasing as people become informed on what we are doing. Sometimes these men in industry have even more faith in the results than we have. He said he had maintained from the beginning that we should work with breed associations and that we now have the interesting picture that an increasing number of associations in a position to do so financially, are underwriting certain phases of research and at least have research committees. Dr. Clark then spoke on, "Where are we now in W-1, the first regional project that was initiated in beef cattle work?" W-1 has produced over 58 scientific publications. This body of information will increase rapidly in the near future. He said Dr. Gregory referred to the fact that we had worked with him very actively. Actually, we had been able to do very little in comparison to the job to be done in this field. He was disturbed by the lack of facilities to give this problem real support. He said dwarfism is the greatest single problem of a genetic nature at the moment and that he hoped we could stem the tide and keep it from being carried over into commercial herds to such an extent that it would reach a national catastrophe. We have evidence that it is already in commercial herds. Therefore, he said, he appreciated California's becoming an active participant in this phase of the project and making a concerted effort to eliminate dwarfism. He said all of the so-called "master breeders" were looking to us for a solution to this problem. He did not know of any major and renowned herd that was entirely free from this problem unless it was owned by an experiment station. Many of the prominent pedigree herds are polluted with this deleterious characteristic. He said he had enjoyed working with people in industry in Hawaii but was particularly gratified to come back home and see the work that Paul Gregory and Carl Roubicek had done this winter in trying to solve the dwarfism problem. He hoped we could have some reservoir of funds, either from the public purse or any other purse, as long as we could acquire support to develop programs that will be sufficiently effective in our lifetimes to get some of these problems solved. We don't want to be sidetracked from our major objectives and when problems like dwarfism arise we should have additional or separate means of support without robbing existing good work. He said he was very glad to see the Committee action in giving the Hawaii project some funds; that Hawaii had a very deserving project which included the most extensive Polled Hereford cattle project within the national program. He quoted some statistics which were presented

by Dr. Byron T. Shaw before a House Committee on February 5, 1952, that showed the amount of research funds spent for every $100 of gross farm income:

1940 - 38.2¢
1950 - 31.5¢
1951 - 28.7¢

Breakdown of this into Federal and State is as follows:

| | | |
|---|---|---|
| 1940 | Federal | 26.5¢ |
| | State | 11.7¢ |
| 1950 | Federal | 17.7¢ |
| | State | 13.8¢ |
| 1951 | Federal | 15¢ |
| | State | 13.7¢ |

In relation to beef cattle income, the Federal Treasury contributes for beef cattle breeding research in all phases only .74¢ per $100 of gross farm income derived from beef cattle, and for all beef research 1¢ per animal.

He said we would have the continuing task of determining where the good work actually is being done and which projects therefore deserved increased support. He had no doubt of the value that was going to come from these three regional projects, W-1, NC-1 and S-10. We have an industry now that is moving so fast that you can really feel it pushing you for research information. In many cases we do not have the information. The most important problem is to get more technically trained people to work with the existing data. If we have money for salaries in the next five years, we need not be too concerned about money for physical plant development. He warned that industry itself may undertake extensive phases of this work if the money to do the job in adequate fashion does not come in from Federal or State sources. If we do not stay ahead of industry in the next five years, which are critical years in this project, industry will catch up and pass us. From a personal standpoint he would like to maintain the position of leadership that animal scientists have come to enjoy during the last five or ten years. He said he had enjoyed working with the new Regional Coordinator, Carl Roubicek, for even a few months. We need to encourage top-notch graduate students to come into this field of animal science and particularly to help use present accumulated data. The analysis of some of these bodies of data will help us to better evaluate our current program. Therefore, we have repeatedly pointed out in recent years to the administrative people concerned that our program will not be completely effective unless we are allowed adequate support for staff electronic equipment and facilities to analyze our data on a current basis. Our present support is pitifully small in relation to the size and scope of the beef cattle industry in whose interests we are devoting our energy.

Dr. Clark again thanked the group for the privilege of working with them and being present these two days.

The Chairman asked if there was any further business.

Dr. Hilston made motion they adjourn. The motion was seconded and carried at 4:30 P. M.